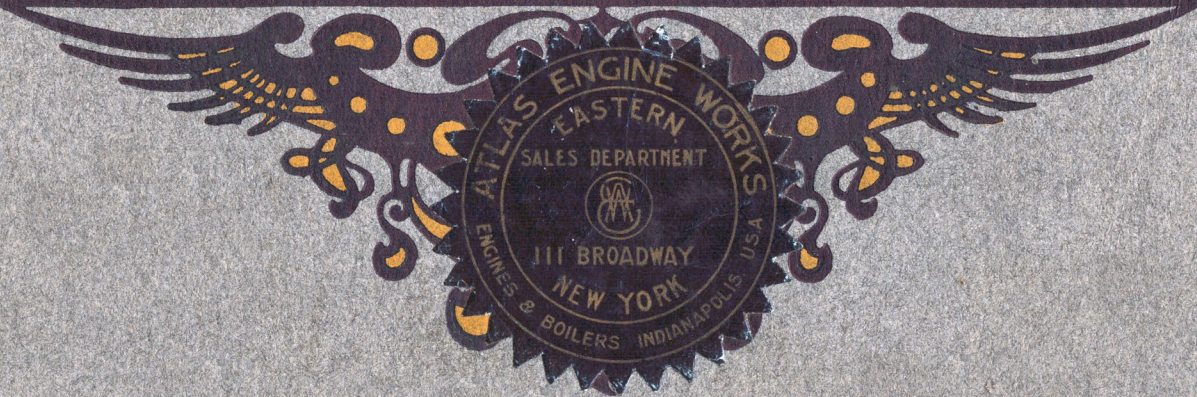
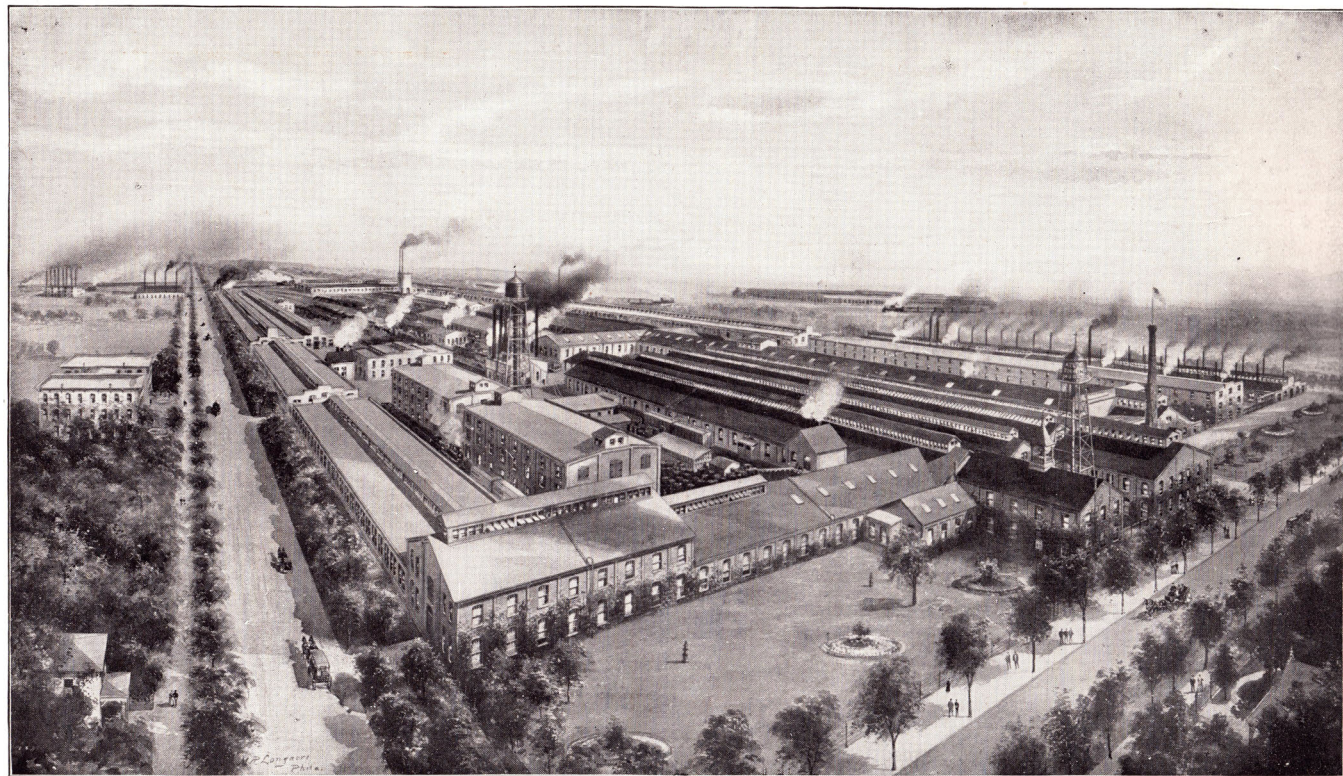


ATLAS FIRE-TUBE BOILERS



ATLAS FIRE-TUBE BOILERS



THE WORKS

ATLAS ENGINE WORKS

BUILDERS OF

ENGINES AND BOILERS

OF QUALITY



No. 125

INDIANAPOLIS, INDIANA, U. S. A.

Contents

INTRODUCTORY	7
GENERAL DESIGN AND CONSTRUCTION OF ALL ATLAS FIRE-TUBE BOILERS	8

GENERAL SPECIFICATIONS AND DESCRIPTIONS:

ATLAS HORIZONTAL TUBULAR BOILERS	11	ATLAS INTERNAL FIRED BOILERS	35
ATLAS LOCOMOTIVE FIRE-BOX BOILERS	26		

DETAILED DIMENSIONS AND SPECIFICATIONS:

HORIZONTAL TUBULAR BOILERS FOR 100 POUNDS WORKING PRESSURE	13, 15	LOCOMOTIVE FIRE BOX BOILERS FOR 100 POUNDS WORKING PRESSURE	29, 31, 33
HORIZONTAL TUBULAR BOILERS FOR 125 POUNDS WORKING PRESSURE	17	INTERNAL FIRED BOILERS FOR 100 POUNDS WORK- ING PRESSURE	37
HORIZONTAL TUBULAR BOILERS FOR 150 POUNDS WORKING PRESSURE	19	VERTICAL BOILERS FOR 100 POUNDS WORKING PRESSURE	39
SIX-INCH FLUE BOILERS FOR 100 POUNDS WORK- ING PRESSURE	21		

INSTALLATION OF STATIONARY TUBULAR BOILERS

DIRECTIONS FOR SETTING STATIONARY TUBULAR BOILERS	43	DIMENSIONS OF SINGLE SETTINGS WITH PLAIN FULL SQUARE FRONT	51
MATERIALS REQUIRED FOR STANDARD STATIONARY BOILER SETTINGS	45	DIMENSIONS OF DOUBLE SETTINGS WITH HALF ARCH HENRY C. FRONTS	53
DIMENSIONS OF SINGLE SETTINGS WITH HALF ARCH HENRY B. FRONT	47	DIMENSIONS OF DOUBLE SETTINGS WITH PLAIN FULL SQUARE FRONTS	55
DIMENSIONS OF SINGLE SETTINGS WITH HALF ARCH HENRY C. FRONT	49		

Contents—*Continued*

DIRECTIONS FOR CARE AND MANAGEMENT OF BOILERS	57
SUGGESTIONS FOR ORDERING	72

TABULATED INFORMATION OF GENERAL INTEREST:

STANDARD MANHOLE AND TUBE ARRANGEMENTS	60	CIRCUMFERENCES OF CIRCLES	66
HEATING SURFACE OF BOILER SHELLS AND TUBES	61	AREAS OF CIRCLES	67
SPECIFICATIONS OF STANDARD BOILER TUBES	62	CAPACITIES OF CYLINDRICAL TANKS	68
SPECIFICATIONS OF BLACK OR GALVANIZED STAND- ARD WEIGHT PIPE	63	EQUATION OF PIPES	69
THICKNESS AND WEIGHTS OF UNITED STATES STAND- ARD GAUGES	64	PROPERTIES OF SATURATED STEAM	70
DECIMAL EQUIVALENTS OF COMMON FRACTIONS	65	PERCENTAGE OF SAVING IN FUEL BY HEATING FEED WATER	71

Illustrations

ATLAS ENGINE WORKS 2

ATLAS STATIONARY BOILERS:

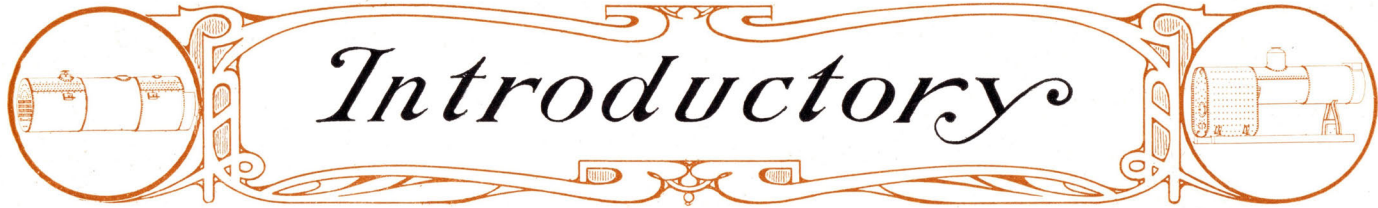
HORIZONTAL TUBULAR BOILERS FOR 100 POUNDS WORKING PRESSURE 12, 14	HORIZONTAL TUBULAR BOILERS FOR 150 POUNDS WORKING PRESSURE 18
HORIZONTAL TUBULAR BOILERS FOR 125 POUNDS WORKING PRESSURE 16	SIX-INCH FLUE BOILERS FOR 100 POUNDS WORK- ING PRESSURE 20

ATLAS PORTABLE BOILERS:

LOCOMOTIVE FIRE BOX BOILERS FOR 100 POUNDS WORKING PRESSURE : 28, 30, 32	ATLAS FIRE FRONTS 22, 23, 24
INTERNAL FIRED BOILERS FOR 100 POUNDS WORK- ING PRESSURE 34, 36	ATLAS GRATE BARS 25
VERTICAL BOILERS FOR 100 POUNDS WORKING PRESSURE 38	ATLAS SMOKE CONNECTIONS 40, 41
	ATLAS STEAM CONNECTIONS BETWEEN BOILERS WITH CUT-OFF VALVES 42

ATLAS STANDARD SETTING PLANS FOR HORIZONTAL TUBULAR BOILERS:

SINGLE SETTING WITH HALF ARCH HENRY B. FRONT . 46	DOUBLE SETTING WITH PLAIN FULL SQUARE FRONTS . 54
SINGLE SETTING WITH HALF ARCH HENRY C. FRONT . 48	SUSPENSION APPARATUS FOR TUBULAR BOILERS
SINGLE SETTING WITH PLAIN FULL SQUARE FRONT . . 50	IN SINGLE, DOUBLE AND TRIPLE SETTINGS . . 56
DOUBLE SETTING WITH HALF ARCH HENRY C. FRONTS 52	



Introductory

ATLAS boilers are well known everywhere. At least one may be found in daily service in nearly every city, town and hamlet in America, while many are in use in foreign lands. Thirty-five thousand Atlas boilers, aggregating twenty-five hundred thousand horse power, speak eloquently for their acceptability to the steam-using public. In response to the growing demand, the facilities have lately been increased until now the Works are capable of producing annually more than 5,000 boilers averaging 100 horse power each. These statistics afford abundant assurance that those qualities which by their attractiveness have contributed so materially to the upbuilding of this great industry will not only be maintained, but improved whenever and wherever possible.

The details and methods of design and construction and the individual characteristics of the several types are fully explained in the pages following. The line is so comprehensive that intending purchasers will find it possible in nearly every instance to select a standard boiler that is particularly adapted to the requirements. However, special boilers are sometimes built according to purchaser's specifications in cases wherein extraordinary local conditions necessitate unusual features of design and the Works are splendidly equipped for the prompt execution of such orders.

An opportunity to figure with all those who are interested in really high grade boilers is respectfully solicited.

ATLAS ENGINE WORKS,
INDIANAPOLIS, IND.

General Design and Construction

As the title indicates, this book is devoted to those styles of stationary and portable boilers in which the tubes, which are surrounded by water, serve as conduits for the passage of the heated gases from the furnace to the smoke box. In this manner these boilers as a type are distinguished from the Atlas water tube boilers which constitute another very important branch of the product of the Works and are fully treated in another book.

Secure in the knowledge that Atlas designs and methods in general are correct and in accordance with the best current knowledge of the art of boiler making, it has always been the policy of this company to make the most thorough exhibition of its products to prospective buyers, and invite the closest scrutiny and comparison with the offerings of other builders. These designs and methods have been adopted as the best only after long experience with thousands of boilers. The result is that the standard boilers shown herein are as staple as wheat or corn and the company does not hesitate to build them in large numbers in advance of orders. Usually any of the standard boilers can be delivered very promptly from storage.

All materials have been selected with especial reference to their adaptability to the service required. The shell plates and heads are open hearth homogeneous flange steel, bearing the maker's stamp of 60,000 pounds tensile strength per square inch of section, with not less than 50 per cent of ductility as indicated by contraction of area at point of fracture under test, an elongation of 25 per cent in a length of 8 inches, and guaranteed by the maker to be capable of bending down flat upon itself when cold, red hot, or after being heated to a cherry red and quenched in cold water, without sign of fracture. The chemical and physical properties are determined by thorough tests and all plates must meet the requirements of the best accepted practice.

The tubes are standard American lap-welded, thoroughly tested in all particulars before they are set in position and again when the boiler is complete. All tubes 4 inches in diameter and smaller are carefully set by roller expanders into reamed and chamfered holes and beaded over against the heads at both ends by pneumatic tools in the hands of skilled

workmen. The 6-inch tubes are firmly riveted into nozzles in the front and back heads, these nozzles being flanged in the direction of the travel of the gases in order that there may be no obstruction to the free passage thereof, or pockets for the accumulation of soot or dust.

The arrangement of tubes as to diameter, number and relative location is the result of years of experience in determining the most efficient and economical distribution of heating surface. In no case, is a multitude of small tubes crowded in to make great show of theoretical heating surface, at the expense of good draft, free water circulation, thorough absorption of heat units, and convenience of cleaning.

The braces and staybolts are of double refined iron, having an ultimate tensile strength of 52,000 pounds per square inch of section, an elastic limit of at least half the tensile strength and an elongation of 18 per cent in a length of 8 inches, and all are set to bear uniform tension. The distribution is such that no single staybolt or brace, either of the crowfoot or through-going form, in boilers built for 100 pounds working pressure, carries a load of more than 7,000 pounds per square inch of section; and 6,000 pounds per square inch of section is the greatest stress allowed on any brace in boilers built for 125 pounds and 150 pounds working pressure. The solid crowfoot braces are carried well back upon the shell plates, so that the angle is very slight, and are attached by two rivets at each end. The through-going braces have adjustable lock nuts at both ends, one end being attached to a heavy flange steel stirrup riveted to the inner face of the head. This provides a flexible joint that takes care of expansion and contraction, and is superior in every respect to the ordinary and less expensive construction which contemplates simply passing the rods through both heads and fastening them rigidly by means of lock nuts inside and out with the frequent result of leakage.

The rivets are of mild steel and can be bent over when cold until the sides meet without developing cracks on the outside of the bent portion. All rivet holes are reamed to perfect fairness and the riveting wherever practicable is done by hydraulic machinery, upsetting the rivet its full length, completely filling the hole and forming a perfect head in line with it. The girth seams are single riveted. The longitudinal seams of all boilers of 36-inch and greater diameter, designed for 100 pounds working pressure, are double lap riveted, the diameter and pitch of the rivets being such that the joint retains about 70 per cent of the strength of the solid plate. In the class V and class X boilers, designed for

125 pounds and 150 pounds working pressure, respectively, the longitudinal seams are of the triple butt-strap construction. Each plate is rolled so that its ends meet evenly, edge to edge, covering straps are laid over the joint both inside and outside of the shell and three rows of rivets are driven on each side of the joint through the covering straps and the shell plates. This form of seam possesses about seven-eighths of the entire strength of the solid plate and admits of high pressure without the necessity of increasing the shell plates to an objectionable thickness.

The flanges on the heads of the boilers are turned at a single stroke of a powerful hydraulic flanging press after having been heated to a uniform bright red in an annealing furnace. The formers are so designed that the knuckle or turn of the flange is the thickest part. There is a total absence of checks and flaws such as result from frequent and partial heating and hammering into shape and the metal is not distorted or unevenly stretched. The manholes and the nozzles for 6-inch flues are flanged in the same manner, and the lip of the manhole flange is accurately faced to secure a perfect joint.

The plates are held together at the riveter so firmly that the process of riveting renders the boiler almost steam-tight, but all seams are carefully caulked with round-nosed pneumatic tools operated at high speed to insure perfect joints.

The designs and methods of construction have all been thoroughly scrutinized by the Hartford Steam Boiler Inspection and Insurance Company and approved by them for a standard line of commercial boilers. The construction, as well as the test after completion, is under their constant surveillance and certificate of such inspection and test by the Insurance company accompanies each boiler. A policy of insurance may also be had at slight additional expense, if desired.

Atlas Horizontal Tubular Boilers

The above title is a general one, applying to all stationary boilers in Classes L, M, N, V, W and X.

More boilers belonging to Classes L, M and N are in service, perhaps, than of any other type. They are adapted to nearly every kind of service for which steam is required at pressure not exceeding 100 pounds.

The Class V and Class X boilers, being built for 125 pounds and 150 pounds working pressure, respectively, are particularly desirable for use in connection with compound engines or other service requiring high pressures.

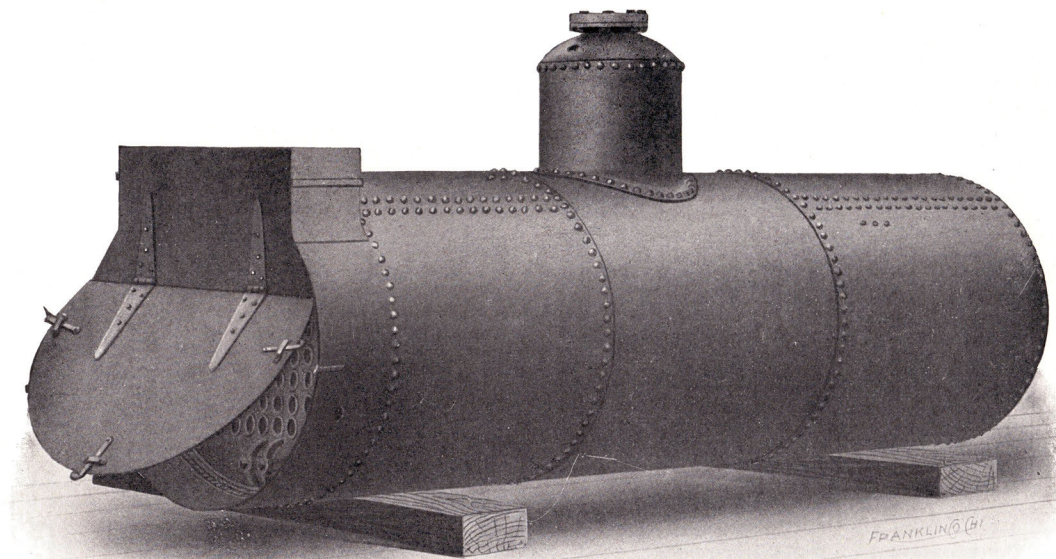
The Class W boilers are admirably suited to locations where the feed water contains a considerable proportion of mud or scale-forming sediment, since the arrangement of the 6-inch tubes in vertical and horizontal rows with a clear space of 3 inches between them each way affords superior facilities for the removal of accumulations from the external surfaces of the tubes, and, furthermore, the gases pass through the 6-inch tubes with much less friction than in the case of smaller tubes, with the result that the loss and annoyance sometimes experienced from the clogging of tubes with soot is practically nullified. The Class W boilers shown herein as standards are designed for 100 pounds working pressure, but many of them are built on special orders for 125 pounds and 150 pounds working pressure.

The shells of all stationary boilers are built in three courses, each course consisting of a single plate which forms the entire circumference of the boiler. The longitudinal seams come well above the fire line and break joints in the different courses in the usual manner. The three-course construction has stood the test of time and service and is recognized as the most desirable by the best authorities.

Each boiler is equipped with a fusible plug in the back head just above the upper row of tubes.

An internal feed pipe enters the front head of each boiler above the tubes near the left hand side, extends nearly to the rear head, crosses over to the other side and discharges downward between the tubes and the shell, after the feed water has taken on practically the same temperature as the water in the boiler.

All 2-inch and larger openings in boiler shells are re-inforced by flanges and an independent flange is provided for the pop safety valve.



ATLAS HORIZONTAL TUBULAR BOILER—CLASS L

FOR 100 POUNDS WORKING PRESSURE

Atlas Horizontal Tubular Boilers---Class L

For 100 Pounds Working Pressure

SPECIFICATIONS FOR SINGLE SETTING

Estimate Number	Nominal Horse Power Rating	Shell		Depth of Smoke Box Inches	Mean Thickness		Fixed Dome		Openings			Tubes			Total Heating Surface Sq. Ft.	Total Grate Surface Sq. Ft.	Stack		Shipping Weight Pounds Approximate		
		Diameter Inches	Length Feet		Shell Inches	Heads Inches	Diameter Inches	Height Inches	Safety Valve Inches	Steam Inches	Blow Off Inches	Number	Diameter Inches	Length Feet			Diameter Inches	Length Feet	Boiler Only	Fixtures Only	Boiler and Fixtures
15L	15	36	8	15	1/4	3/8	18	20	1 1/2	2	2	24	3	8	201	6.00	18	30	2376	1624	4000
20L	20	36	10	15	1/4	3/8	18	20	2	2	2	24	3	10	251	7.50	18	30	2785	1715	4500
25L	25	36	12	15	1/4	3/8	18	20	2	2 1/2	2	24	3	12	301	9.00	18	35	3129	1971	5100
30L	30	40	12	15	1/4	3/8	20	22	2 1/2	2 1/2	2	30	3	12	366	12.25	20	40	3727	2273	6000
35L	35	42	12	15	1/4	7/8	20	22	2 1/2	2 1/2	2	36	3	12	427	14.00	22	40	4151	2349	6500
40L	40	46	12	15	3/8	7/8	24	24	3	3	2	42	3	12	491	16.00	22	40	5039	2561	7600
45L	45	48	12	15	3/8	7/8	24	24	3	3	2	48	3	12	551	16.00	24	40	5450	2650	8100

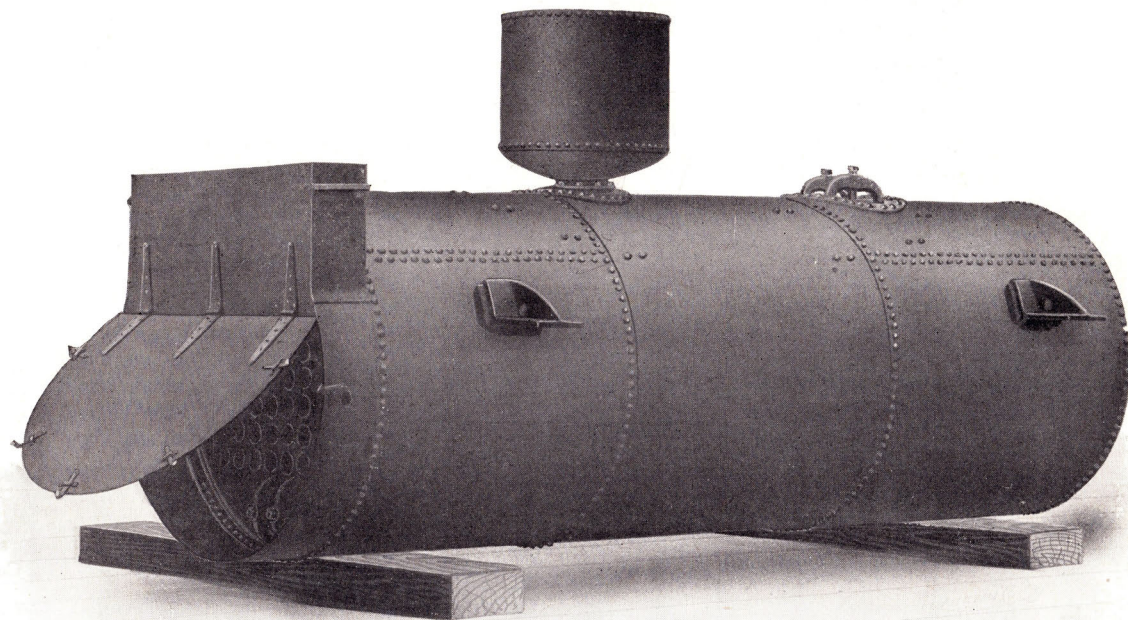
Each Boiler is furnished with Dome, Extended Shell to form Smoke Box, Smoke Head Door and Stack Saddle, Fire Front (Class B), Grate Bars, Bearing Bars, Back Stand, Back Arch Frames, Round Soot Pit Door and Frame, Pop Safety Valve, Steam Gage and Siphon, Water Column and Connections, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Internal Feed Pipe, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note—Independent Dome, or Dry Pipe without Dome, can be furnished if preferred.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.



ATLAS HORIZONTAL TUBULAR BOILER—CLASSES M AND N

FOR 100 POUNDS WORKING PRESSURE

Atlas Horizontal Tubular Boilers---Classes M and N

For 100 Pounds Working Pressure

SPECIFICATIONS FOR SINGLE SETTING

Estimate Number	Nominal Horse Power Rating	Shell		Depth of Smoke Box	Mean Thickness		Independent Dome		Openings			Tubes			Total Heating Surface	Total Grate Surface	Stack		Shipping Weight Pounds Approximate																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		Diameter Inches	Length Feet		Shell Inches	Heads Inches	Diameter Inches	Height Inches	Safety Valve Inches	Steam Inches	Blow Off Inches	Number	Diameter Inches	Length Feet			Diameter Inches	Length Feet	Boiler Only	Fixtures Only	Boiler and Fixtures																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
																						Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches

Each Boiler is furnished with Dome, Extended Shell to form Smoke Box, Smoke Head Door and Stack Saddle, Fire Front (Class C), Grate Bars, Bearing Bars, Wings, Back Arch Frames, Round Soot Pit Door and Frame, Pop Safety Valve, Steam Gage and Siphon, Water Column and Connections, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Internal Feed Pipe, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

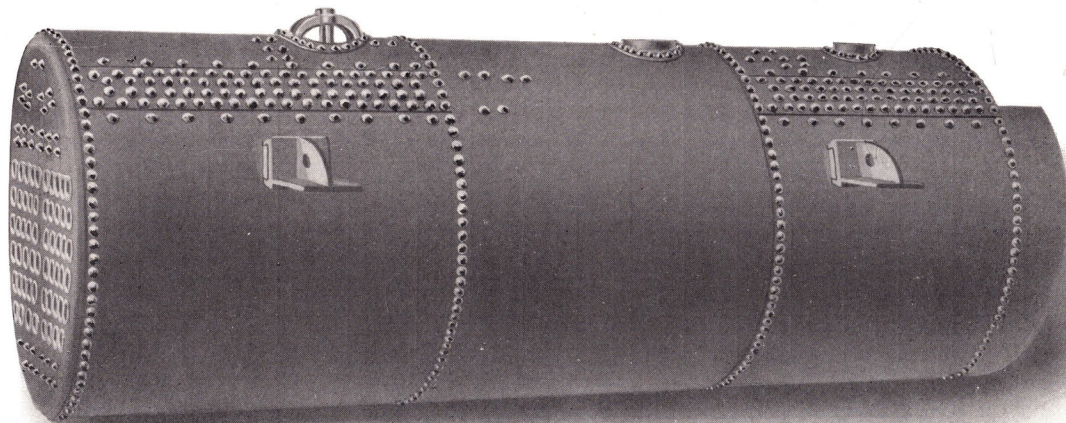
Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note—Fixed Dome, or Dry Pipe without Dome, can be furnished if preferred.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.

ATLAS FIRE-TUBE BOILERS



ATLAS HIGH PRESSURE TUBULAR BOILER—CLASS V

FOR 125 POUNDS WORKING PRESSURE

Atlas High Pressure Tubular Boilers---Class V

For 125 Pounds Working Pressure

SPECIFICATIONS FOR SINGLE SETTING

Estimate Number	Nominal Horse Power Rating	Shell		Depth of Smoke Box	Mean Thickness		Openings			Tubes			Total Heating Surface	Total Grate Surface	Stack		Shipping Weight Pounds Approximate		
		Diamete- r	Length		Shell	Head	Safety Valve Inches	Steam Inches	Blow Off Inches	Number	Diamete- r	Length			Diamete- r	Length	Boiler Only	Fixtures Only	Boiler and Fixtures
				Inches									Feet	Inches					
50V	50	48	14	15	$\frac{9}{8}$	$\frac{7}{8}$	3	3	2	36	3½	14	579	18.00	24	40	6598	2602	9200
60V	60	54	14	15	$\frac{9}{8}$	$\frac{1}{2}$	3	3½	2	44	3½	14	696	20.25	26	40	8270	3530	11800
70V	70	54	16	15	$\frac{9}{8}$	$\frac{1}{2}$	3	4	2	36	4	16	756	20.25	26	45	9548	3652	13200
85V	85	60	16	15	$\frac{11}{8}$	$\frac{1}{2}$	3½	4½	2	44	4	16	907	22.50	28	45	11653	4047	15700
100V	100	66	16	15	$\frac{3}{8}$	$\frac{1}{2}$	3½	4½	2	54	4	16	1091	24.75	32	50	14107	4993	19100
125V	125	72	16	15	$\frac{7}{8}$	$\frac{1}{2}$	4	5	2	70	4	16	1377	30.00	34	60	17607	5493	23100
150V	150	72	18	15	$\frac{7}{8}$	$\frac{1}{2}$	4	6	2	70	4	18	1549	32.50	34	60	18907	5993	24900

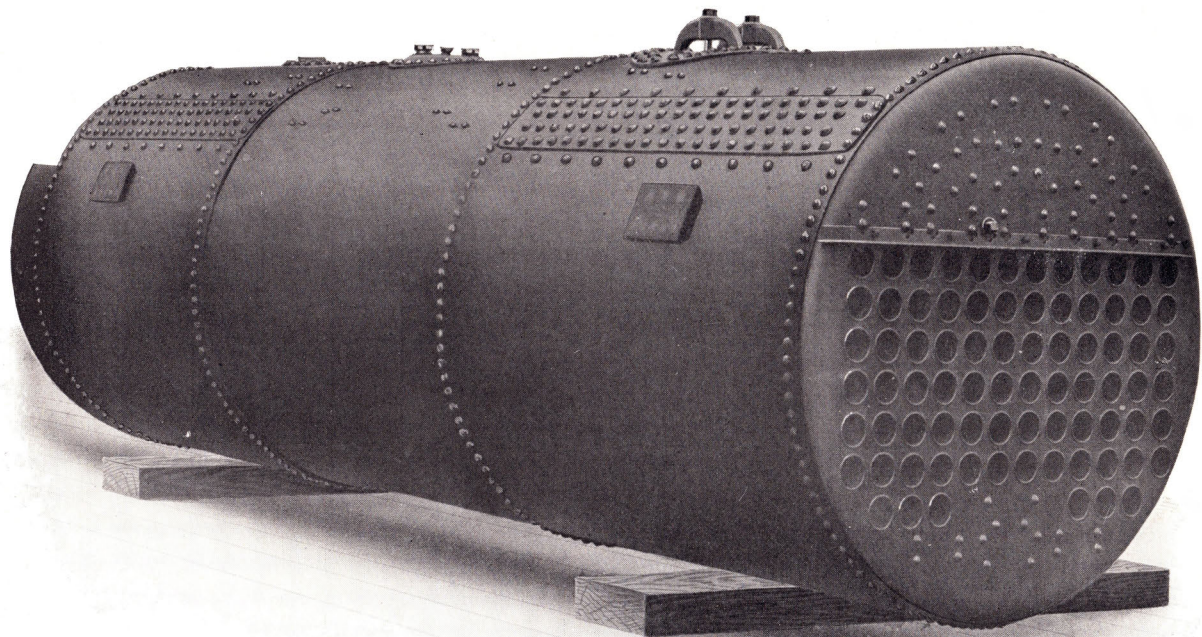
Each Boiler is furnished with Extended Shell to form Smoke Box, Smoke Head Door and Stack Saddle, Fire Front (Class C), Grate Bars, Grate Bearing Bars, Wings, Back Arch Frames, Round Soot Pit Door and Frame, Pop Safety Valve, Steam Gage and Siphon, "C" Water Column and Connections, Glass Water Gage, Gage Cocks, Check Valve, Stop Valve, Internal Feed Pipe, Blow-off Valve with Renewable Seat, Smoke Stack and Guy Wire Cable four times the length of Stack.

Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note—Independent Dome, or Dry Pipe without Dome, can be furnished if desired.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.



ATLAS HIGH PRESSURE TUBULAR BOILER—CLASS X

FOR 150 POUNDS WORKING PRESSURE

Atlas High Pressure Tubular Boilers---Class X

For 150 Pounds Working Pressure

SPECIFICATIONS FOR SINGLE SETTING

Estimate Number	Nominal Horse Power Rating	Shell		Depth of Smoke Box	Mean Thickness		Openings			Tubes			Total Heating Surface	Total Grate Surface	Stack		Shipping Weight Pounds Approximate		
		Diamete- r	Length		Shell	Heads	Safety Valve Inches	Steam Inches	Blow Off Inches	Number	Diamete- r	Length			Diamete- r	Length	Boiler Only	Fixtures Only	Boiler and Fixtures
70X	70	54	16	15	3.9 1 0 0	5 0 1 0	3	4	2	36	4	16	756	20.25	26	45	10747	5253	16000
85X	85	60	16	15	4.3 1 0 0	5 5 1 0	3 1/2	4 1/2	2	44	4	16	907	22.50	28	45	12982	5618	18600
100X	100	66	16	15	4.8 1 0 0	6 0 1 0	3 1/2	4 1/2	2	54	4	16	1091	24.75	32	50	16507	6593	23100
125X	125	72	16	15	5.3 1 0 0	6 5 1 0	4	5	2	70	4	16	1377	30.00	34	60	18896	7304	26200
150X	150	72	18	15	5.8 1 0 0	7 0 1 0	4	6	2	70	4	18	1549	32.50	34	60	21187	7313	28500

Each Boiler is furnished with Extended Shell to form Smoke Box, Plates and Rollers for Rear Wing Bearings, Plain Full Square Fire Front, Grate Bars, Grate Bearing Bars, Wings, Back Arch Frames, Breeching Frame, Round Top Soot Pit Door and Frame, Pop Safety Valve, 8 1/2-inch Steam Gage and Siphon, "C" Water Column and Connections, Glass Water Gage, Gage Cocks, Check and Stop Valves with Renewable Disks, Internal Feed Pipe, Blow-off Valve, with Renewable Seat, Smoke Stack and Guy Wire Cable four times the length of Stack.

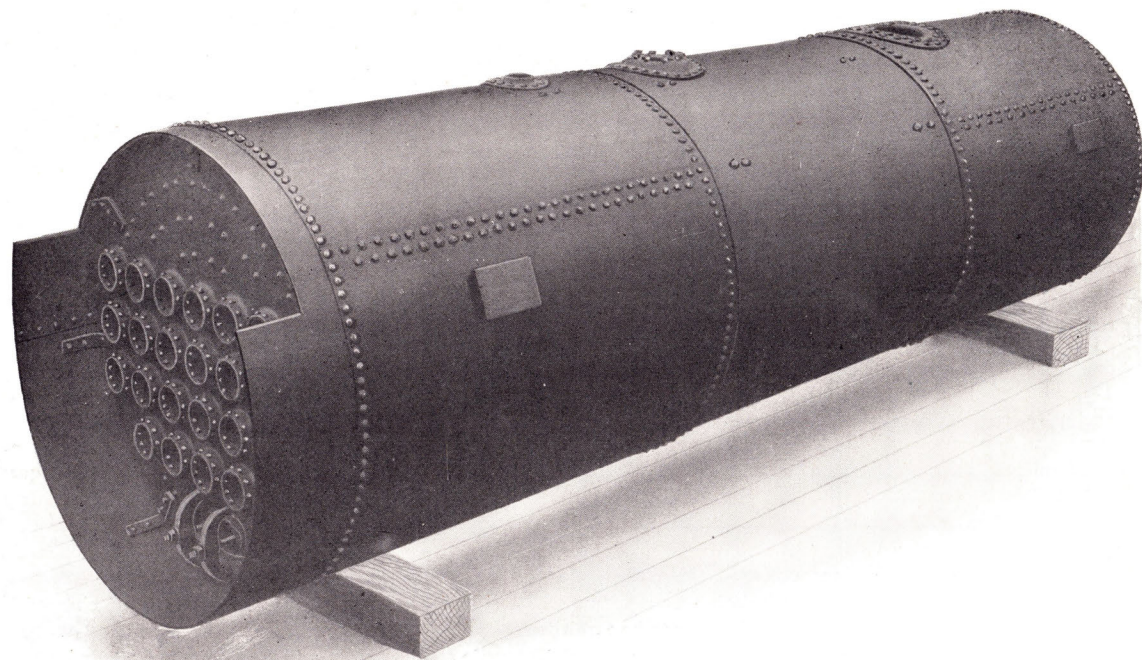
Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note—Independent Dome, or Dry Pipe without Dome, can be furnished if desired.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.

ATLAS FIRE-TUBE BOILERS



ATLAS SIX-INCH FLUE BOILER—CLASS W

FOR 100 POUNDS WORKING PRESSURE

Atlas Six-Inch Flue Boilers---Class W

For 100 Pounds Working Pressure

SPECIFICATIONS FOR SINGLE SETTING

Estimate Number	Nominal Horse Power Rating	Shell		Depth of Smoke Box Inches	Mean Thickness		Independent Dome		Openings			Tubes			Total Heating Surface Sq. Ft.	Total Grate Surface Sq. Ft.	Stack		Shipping Weight Pounds Approximate		
		Diameter Inches	Length Feet		Shell Inches	Heads Inches	Diameter Inches	Height Inches	Safety Valve Inches	Steam Inches	Blow Off Inches	Number	Diameter Inches	Length Feet			Diameter Inches	Length Feet	Boiler Only	Fixtures Only	Boiler and Fixtures
50W	50	46	20	15	$\frac{9}{16}$	$\frac{7}{8}$	24	24	3	3	2	10	6	20	474	16.00	22	40	6883	2717	9400
60W	60	48	20	15	$\frac{9}{16}$	$\frac{7}{8}$	24	24	3	3½	2	12	6	20	544	18.00	24	40	7339	2861	10200
70W	70	56	20	15	$\frac{5}{8}$	$\frac{1}{2}$	28	26	3	3½	2	14	6	20	635	20.25	26	40	9200	3700	12900
80W	80	60	20	15	$\frac{11}{16}$	$\frac{1}{2}$	32	32	3½	4½	2	16	6	20	712	22.50	28	45	10861	3939	14800
100W	100	66	20	15	$\frac{3}{8}$	$\frac{1}{2}$	32	32	3½	4½	2	20	6	20	859	24.75	32	50	12916	4884	17800
125W	125	72	20	15	$\frac{7}{8}$	$\frac{1}{2}$	32	32	4	5	2	26	6	20	1066	30.00	34	60	15916	5384	21300

Each Boiler is furnished with Dome, Smoke Box Extension bolted on, Smoke Head Door and Stack Saddle, Fire Front (Class C), Grate Bars, Bearing Bars, Wings, Back Arch Frames, Round Soot Pit Door and Frame, Pop Safety Valve, Steam Gage and Siphon, Water Column and Connections, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Internal Feed Pipe, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

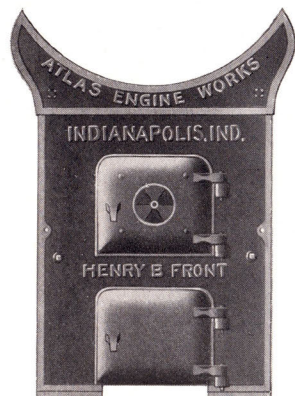
Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

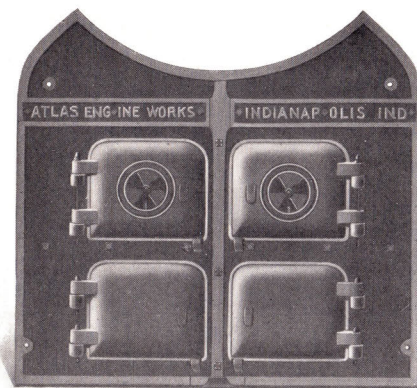
Note—Fixed Dome, or Dry Pipe without Dome, can be furnished if preferred.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.

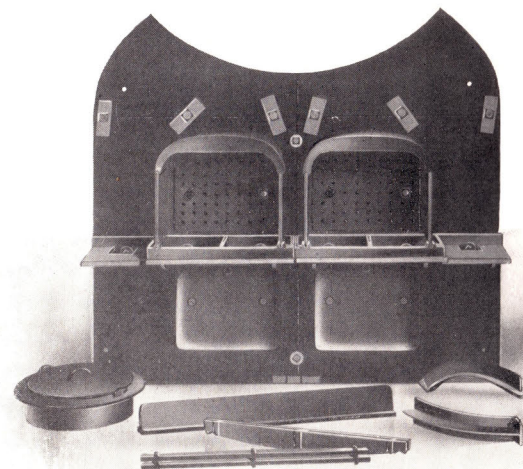
ATLAS FIRE-TUBE BOILERS



HENRY B FRONT

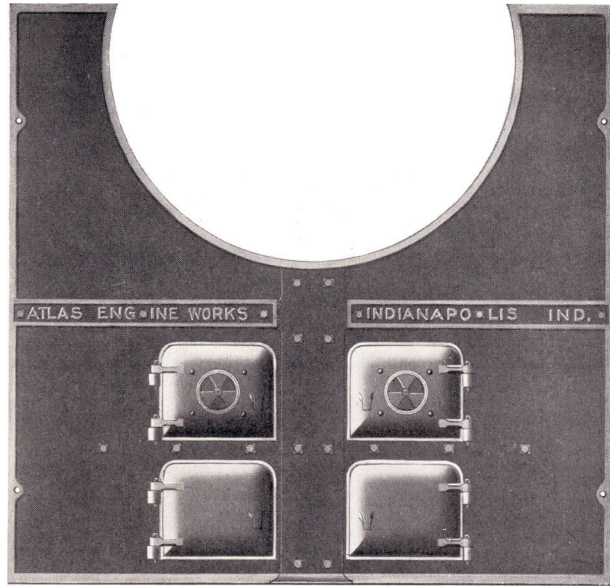


HENRY C FRONT



HENRY C FRONT—REAR VIEW
ALSO USUAL FURNACE CASTINGS

ATLAS FIRE FRONTS



THREE QUARTER FRONT
ATLAS FIRE FRONTS

The several styles of fire fronts shown on pages 22, 23 and 24 are Standards and are sufficient in variety to meet the demands of the trade.

Fronfs can be arranged to suit mechanical stokers, dutch ovens or patented grates, when desired.

The fire and ash doors are large and of the same size on all fronts. For bulky fuel, like wood, the fire doors of all double door fronts can be thrown together in one large opening if mentioned when ordering.

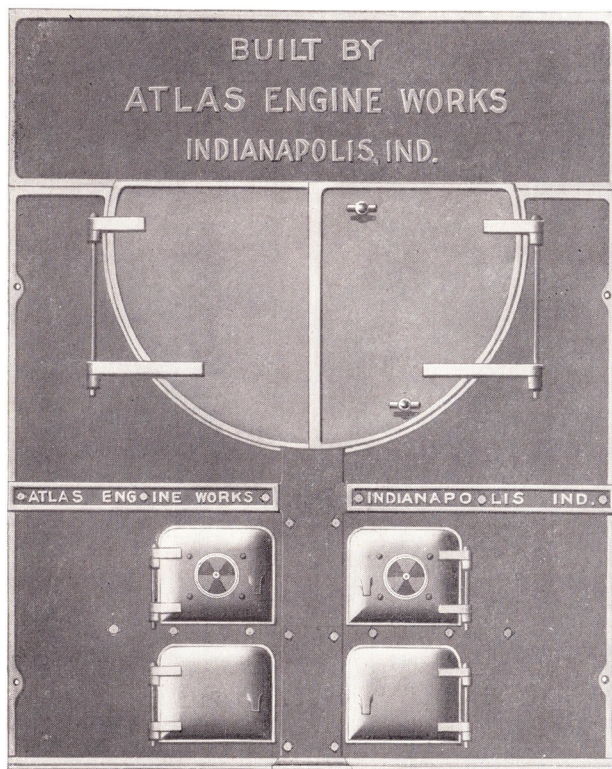
The weight and thickness of metal are ample for all purposes.

As the majority of buyers avoid unnecessary expense and have no particular desire for a show front, the Henry B pattern has been selected for all Standard Estimates up to and including the 48" x 12' boiler. In Standard Estimates for all larger boilers (except the Class X, which include plain full square fronts) the Henry C fronts are listed and all bids are made accordingly unless otherwise mentioned.

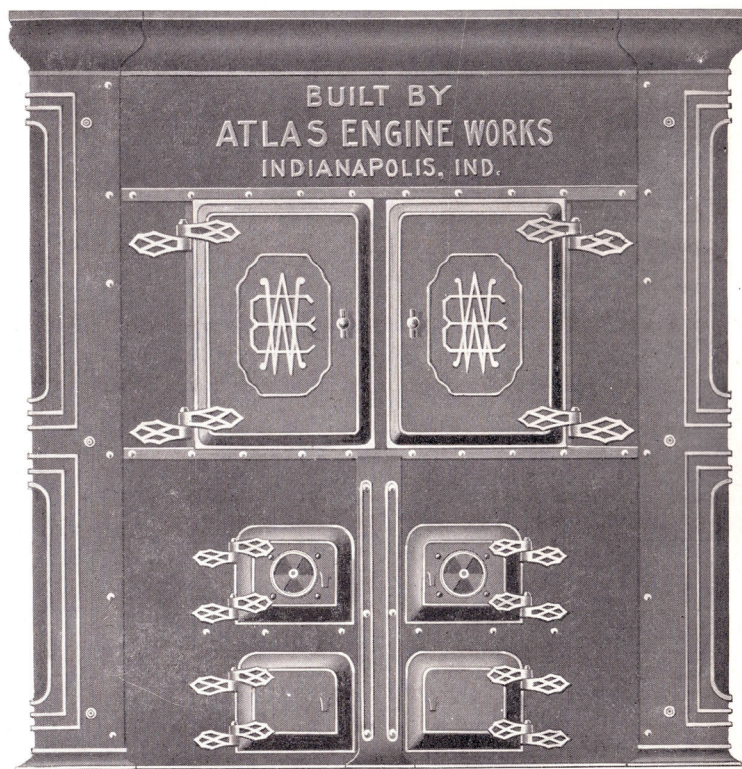
The ornamental front is handsome and suitable for installations which require that more attention should be given to elaborate appearance.

The plain full square front takes the place of the ornamental where a good substantial flush front is wanted and ornamentation is not an object.

The three quarter front is too well known to require comment and in some sections is preferred to all other styles.

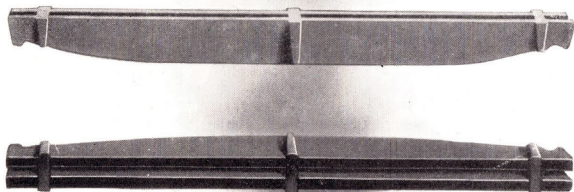


PLAIN FULL SQUARE FRONT

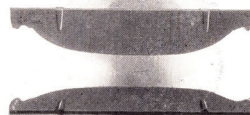


ORNAMENTAL FULL SQUARE FRONT

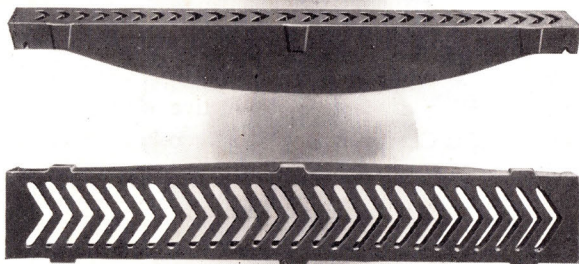
ATLAS FIRE FRONTS



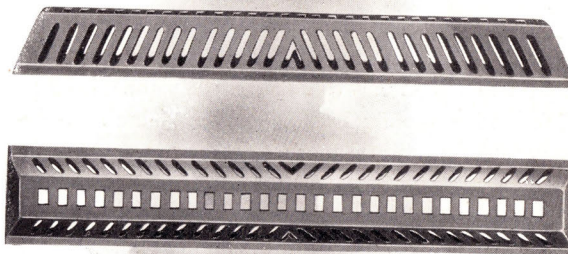
TWO-FINGER GRATE BAR



SECTIONAL GRATE BAR



TUPPER OR HERRINGBONE GRATE BAR



SAWDUST GRATE BAR

ATLAS GRATE BARS

Atlas Locomotive Boilers

These boilers are built in three styles; the Class P, with water front and water bottom fire box, from 10 to 40 horse power; the Class Q, with water front and open bottom fire box, from 50 to 70 horse power, and the oil country type with water front and open bottom fire-box, extra large fixed dome and contracted waist, 20 and 25 horse power.

Several important characteristics distinguish Atlas locomotive boilers from those offered by competing builders. In the first place, the proportions and dimensions throughout are more liberal. The allowance of heating surface is in excess of $12\frac{1}{2}$ square feet per horse power in the boilers of from 10 to 40 horse power and 12 square feet or more in all of the larger boilers. The practice of other builders in this respect varies, some of them going so far as to claim one horse power for every 9 feet of heating surface provided. The catalogue rating of a boiler is a nominal thing. Its real capacity is in direct relation to the quantity and efficiency of heating surface it possesses and the purchaser will find, upon carefully comparing the specifications, that the 25 horse power Atlas locomotive boiler has as much heating surface, and as much capacity, as the so-called 30 horse power boilers of many competitors and the larger Atlas boilers are in nearly every case equal to other boilers that are rated from 10 to 15 horse power higher.

It has long been understood among the best engineers that for direct draft, as in locomotive boilers, the use of tubes of from 2 to $2\frac{1}{2}$ inches diameter rather than larger ones in lengths not exceeding 10 feet, is productive of the most efficient and economical results, and $2\frac{1}{2}$ -inch tubes are therefore used in all Atlas Class P boilers, 10 to 40 horse power. This practice would be more general but for the fact that a foot of heating surface in a $2\frac{1}{2}$ -inch tube costs between 10 and 15 per cent more than a corresponding amount of heating surface in a 3-inch tube, which is the size commonly used.

A great many builders of locomotive boilers furnish water fronts only as extras at an additional price and regularly leave open the front end as well as the bottom of the fire box, simply attaching a cheap cast iron front, the lining of which soon falls down and in consequence the front cracks and becomes a source of continual annoyance and expense,

while they provide no ash pit at all except as an extra. All Atlas locomotive boilers have the more desirable and initially more costly water fronts, and the fire boxes of the Class P boilers, from 10 to 40 horse power, have water bottoms also.

The oil country and Class Q boilers have open bottom fire boxes, the connection between the inside and outside plates being made with an ogee flange. The fire door and ash door openings of all Atlas locomotive boilers are flanged in like manner, thus doing away with the objectionable door rings and mud rings which make poor joints and not unfrequently crack, necessitating replacement at enormous expense.

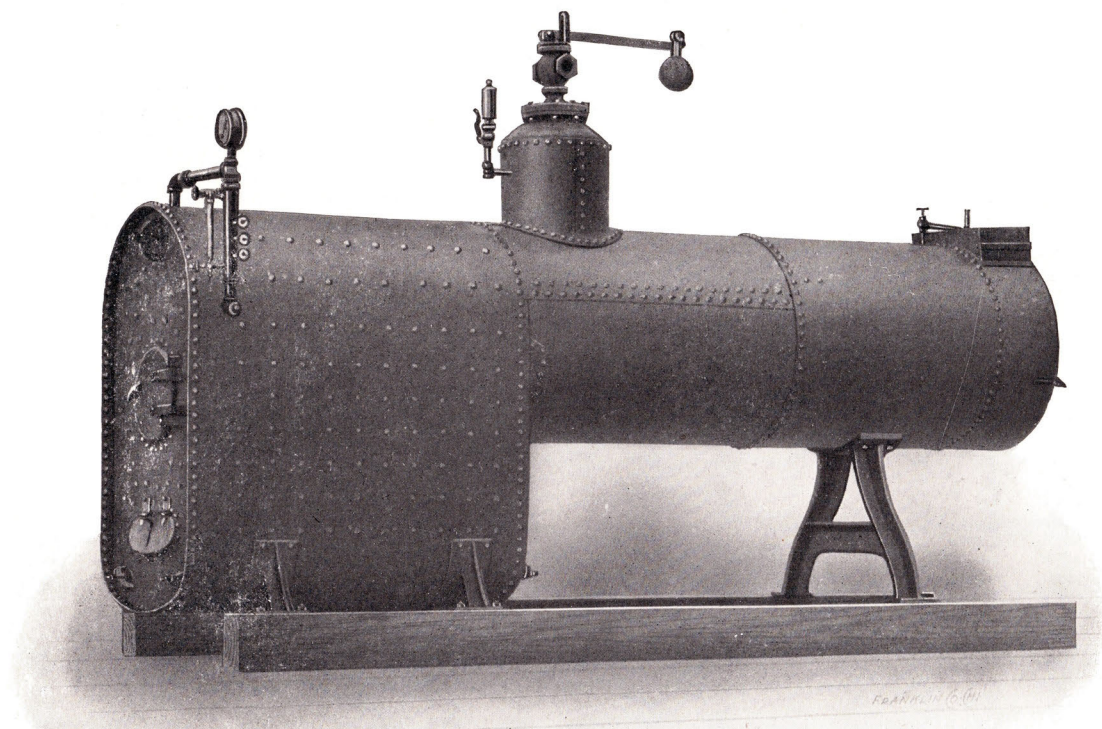
Atlas locomotive boilers are well supplied with manholes and handholes so arranged as to provide the most convenient access for cleaning the interior surfaces.

A hollow plug filled with soft fusible metal is fitted into the crown sheet of each fire box for protection in event of low water.

Many locomotive boilers go into inexperienced hands and this fact is provided for in Atlas boilers by the simplest, safest, most desirable design, careful construction and thorough inspection.

The Class P and Class Q boilers are mounted on heavy skid timbers by means of stocky cast iron supports for ordinary service, and, when so desired, they can be furnished with axles, iron or wooden wheels, tongue, whiffletrees, driver's seat, etc., for convenient and more frequent transportation. The whole system of mounting is durable and reliable. The oil country boilers are not mounted.

For certain kinds of service combination engine and boiler outfits, portable and semi-portable, are popular. A self-contained (center crank) engine fixed on a set of cast iron brackets fitted to the top of a locomotive boiler forms what is termed an over outfit, which may be on skids or on iron or wooden wheels. A self-contained (center crank) engine fixed on skids directly underneath the barrel of a locomotive boiler forms what is termed an under outfit, which may also be on skids or on wheels. A heavy duty (side crank) engine fixed on skids at one side of a locomotive boiler, the main shaft extending through to the band wheel which overhangs the pillow block on the opposite side of the boiler, forms what is termed a semi-fixed outfit.



ATLAS LOCOMOTIVE BOILER—CLASS P

FOR 100 POUNDS WORKING PRESSURE

Atlas Locomotive Boilers---Class P

With Water Front and Water Bottom

For 100 Pounds Working Pressure

SPECIFICATIONS

Esti- mate Number	Nominal Horse Power Rating	Shell		Fire Box			Fixed Dome		Size of Steam Outlet	Tubes			Total Heating Surface	Stack		Shipping Weight Pounds Approximate		
		Dia-me- ter	Length Over All	Length	Width	Height	Dia-me- ter	Height		Number	Dia-me- ter	Length		Dia-me- ter	Length	Boiler Only	Fixtures Only	Boiler and Fixtures
		Inches	Ft. In.	Inches	Inches	Inches	Inches	Inches			Inches	Ft. In.	Sq. Ft.	Inches	Feet			
10P	10	28	9 5	30	23 ½	36	15	16	1 ½	25	2 ½	5 6	127	10	15	2754	446	3200
15P	15	32	11 0	42	27 ½	41	15	16	2	34	2 ½	6 0	188	12	15	3829	671	4500
20P	20	34	12 8	48	29 ½	46	15	16	2	40	2 ½	7 0	251	12	20	4902	798	5700
25P	25	36	14 0	52	32	49	18	20	2 ½	45	2 ½	8 0	315	14	25	5832	968	6800
30P	30	40	15 2	54	36	47 ½	20	22	2 ½	49	2 ½	9 0	376	18	35	6636	1364	8000
40P	40	42	16 2	54	37	60	20	22	3	62	2 ½	10 0	510	20	40	8445	1555	10000

Each Boiler is mounted on Skids and furnished with Dome, Grate Bars, Pop Safety Valve, Steam Gage and Siphon, Water Column and Connections, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

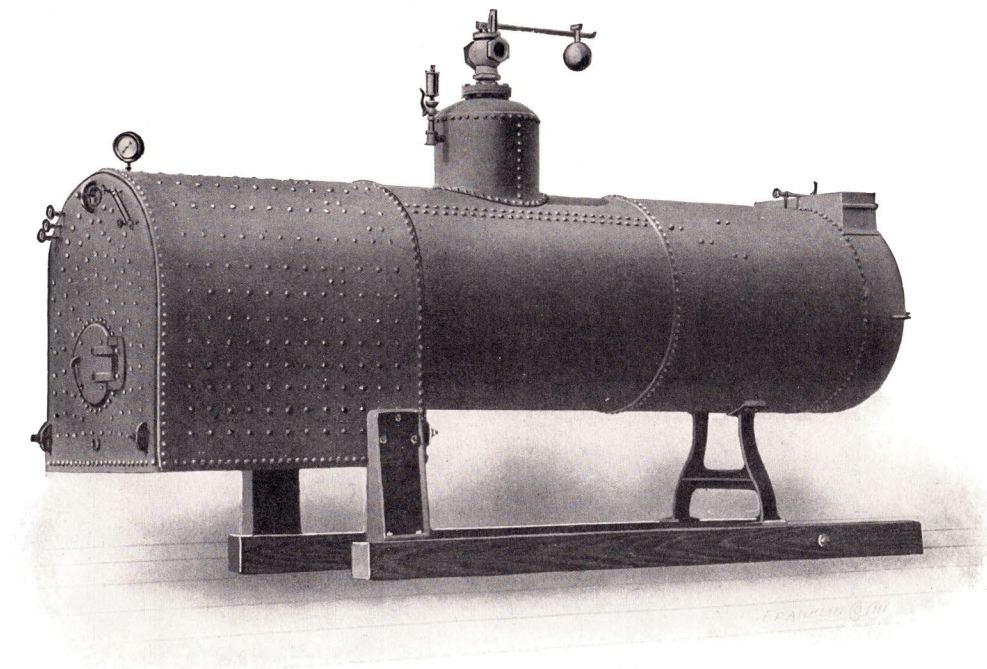
Note—Independent Dome can be furnished if preferred.

Any of the above Boilers can be mounted on wheels, if desired.

All plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength, and to turn down double cold without fracture.

Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.

ATLAS FIRE-TUBE BOILERS



ATLAS LOCOMOTIVE BOILER—CLASS Q

FOR 100 POUNDS WORKING PRESSURE

Atlas Locomotive Boilers---Class Q

With Water Front and Open Bottom

For 100 Pounds Working Pressure

SPECIFICATIONS

Esti- mate Number	Nominal Horse Power Rating	Shell		Fire Box			Fixed Dome		Size of Steam Outlet	Tubes			Total Heating Surface	Stack		Shipping Weight Pounds Approximate		
		Dia- meter	Length Over All	Length	Width	Height	Dia- meter	Height		Number	Dia- meter	Length		Dia- meter	Length	Boiler Only	Fixtures Only	Boiler and Fixtures
		Inches	Ft. In.	Inches	Inches	Inches	Inches	Inches		Inches	Inches	Feet		Inches	Feet			
50Q	50	50	17 6	60	44	46	24	24	3	60	3	11	600	22	40	9500	2000	11500
60Q	60	52	18 6	60	46	48	28	26	3½	68	3	12	725	24	40	10922	2078	13000
70Q	70	54	19 6	60	48	50	28	26	3½	76	3	13	870	26	40	12670	2330	15000

Each Boiler is mounted on Skids and furnished with Dome, Grate Bars, Pop Safety Valve, Steam Gage and Siphon, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

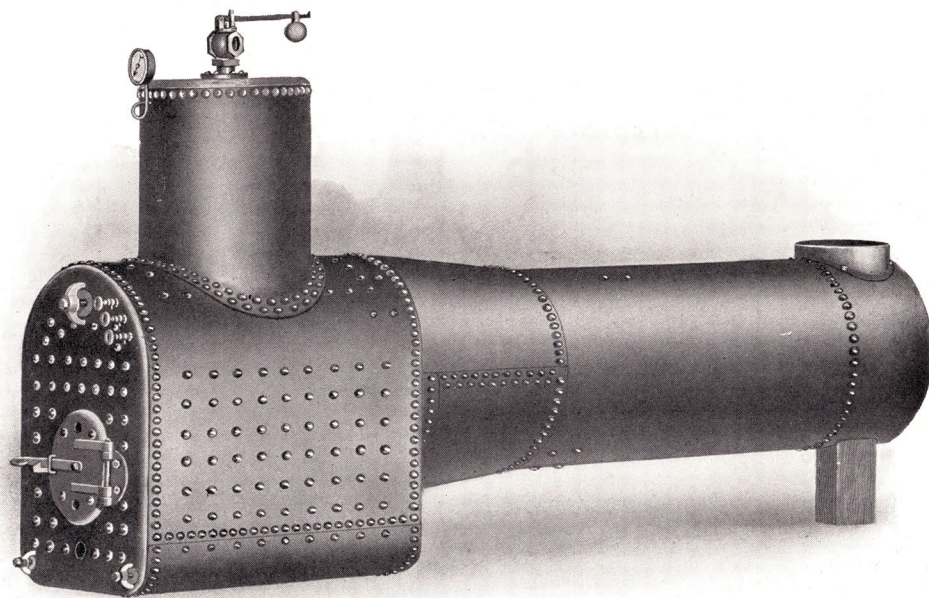
Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note—Independent Dome or Dry Pipe without Dome, can be furnished if preferred.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler

ATLAS FIRE-TUBE BOILERS



ATLAS LOCOMOTIVE BOILER—OIL COUNTRY TYPE

FOR 100 POUNDS WORKING PRESSURE

Atlas Locomotive Boilers—Oil Country Type

With Water Front, Contracted Waist and Open Bottom

For 100 Pounds Working Pressure

SPECIFICATIONS

Estimate Number	Nominal Horse Power Rating	Shell		Fire Box			Fixed Dome		Size of Steam Outlet	Tubes			Total Heating Surface	Stack		Shipping Weight Pounds Approximate		
		Diam. In.	Length Over All Ft. In.	Length In.	Width In.	Height In.	Diam. In.	Height In.		No.	Diam. In.	Length Ft.		Diam. In.	Length Ft.	Boiler Only	Fixtures Only	Boiler and Fixtures
	20	36	13 10¼	49¼	36	38	30	32	2	36	3	8	280	18	22	5600	650	6250
	25	40	13 10¼	49¼	40	41	32	32	2½	45	3	8	336	20	22	6450	750	7200

Each Boiler is furnished with Fixed Dome, Grate Bars, Ball and Lever Safety Valve, Steam Gage and Siphon, Gage Cocks, Check Valve, Stop Valve, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

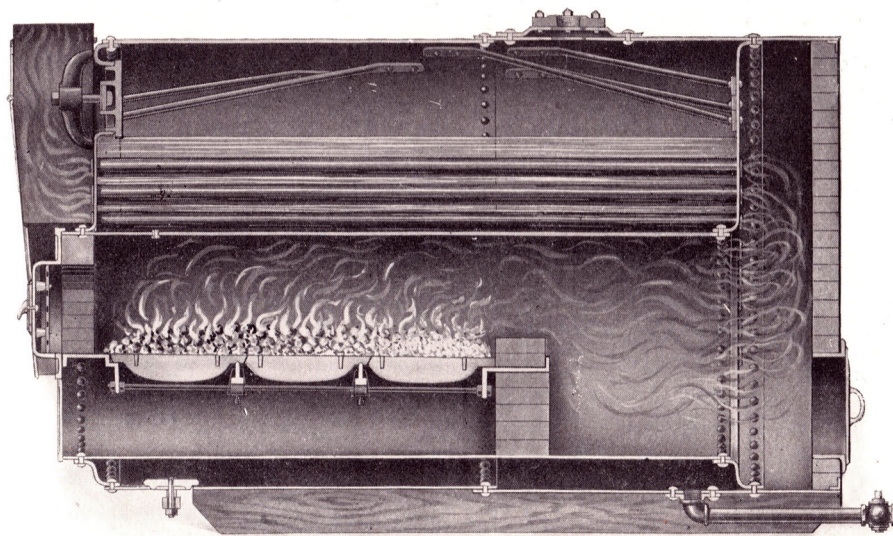
Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

NOTE—The above boilers are specially designed for use in the oil and gas regions; having large steam space, flanged and enlarged water leg at bottom to afford an ample settling chamber, hand holes conveniently placed for cleaning, longitudinal seams double riveted, all flat surfaces liberally stayed and braced, fire door opening flanged.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture.

Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.



ATLAS INTERNAL FIRED BOILER—CLASS Y

LONGITUDINAL SECTION, SHOWING INTERNAL ARRANGEMENT

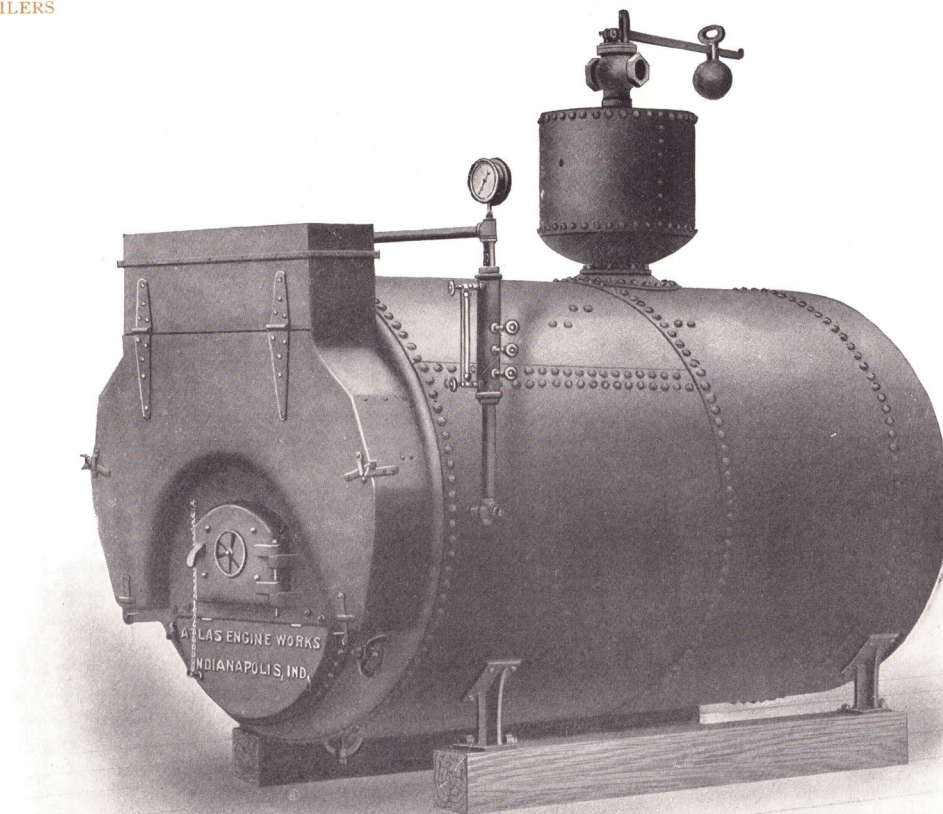
Atlas Internal Fired Boilers

This boiler, commonly known as the Scotch Marine type, combines the advantages of portability with practically the economy of a permanent setting in brickwork. It is entirely self-contained, of a convenient form for handling, and since no masonry is required, it can be installed at very small expense. The boiler rests on skids very close to the ground and, by reason of its compactness is peculiarly adapted to situations where the headroom is limited as in cellars and basements, which fact has led to its very general adoption for heating plants on both gravity return and pressure systems, though this is but one of the many things for which this boiler is used. Its field is apparently unlimited.

The grates are in the front end of the large furnace flue, whence the heated gases pass into the combustion chamber at the rear, returning through a series of 3-inch tubes to the smoke box at the front end, thus deriving the greatest possible benefit from the heat units contained in the fuel. The hottest part of the boiler is the upper portion of the furnace flue and the rapid circulation of the water carries the impurities away from this point, allowing them to sink down into the cooler space below the ash pit where, instead of baking hard against the plates, they remain in a soft, sludge-like state, easily removable by blowing down or by washing out through the two handholes in the front head below the flue and the one in the bottom of the shell directly beneath the grates. A large manhole in the front head above the tubes further increases the cleaning facilities.

A hollow plug filled with soft fusible metal is fitted into the furnace flue directly over the grates for protection in the event of low water.

For certain kinds of service, portable and semi-portable outfits, consisting of the combination of a self-contained (center crank) engine fixed on a set of cast brackets fitted on the top of an internal fired boiler, and the whole mounted either on skids or on wheels, are popular.



ATLAS INTERNAL FIRED BOILER—CLASS Y

FOR 100 POUNDS WORKING PRESSURE

Atlas Internal Fired Boilers---Class Y

For 100 Pounds Working Pressure

SPECIFICATIONS

Estimate Number	Nominal Horse Power Rating	Shell		Furnace		Mean Thickness			Independent Dome		Size of Steam Outlet Inches	Return Tubes			Total Heating Surface Sq. Ft.	Stack		Shipping Weight Pounds Approximate		
		Diameter	Length Over All	Diameter	Length	Shell	Heads	Flue	Diameter	Height		Number	Diameter	Length		Diameter	Length	Boiler Only	Fixtures Only	Boiler and Fixtures
		Inches	Ft. In.	Inches	Inches	Inches	Inches	Inches	Inches	Inches			Inches	Feet		Inches	Feet			
10Y	10	40	9 11	20	30	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	15	16	1½	16	3	8	138	12	25	4529	471	5000
15Y	15	46	10 2	24	40	$\frac{1}{4}$	$\frac{7}{16}$	$\frac{13}{16}$	15	16	2	24	3	8	196	14	25	5513	687	6200
20Y	20	52	10 2	26	46	$\frac{5}{8}$	$\frac{7}{16}$	$\frac{13}{16}$	15	16	2	30	3	8	240	16	25	6621	779	7400
25Y	25	56	10 2	28	50	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{17}{16}$	18	20	2½	38	3	8	300	18	30	7555	1045	8600
30Y	30	60	10 2	30	50	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{7}{16}$	20	22	2½	47	3	8	362	20	30	8818	1182	10000
40Y	40	66	10 2	34	56	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	24	24	3	66	3	8	484	24	30	10513	1387	12100

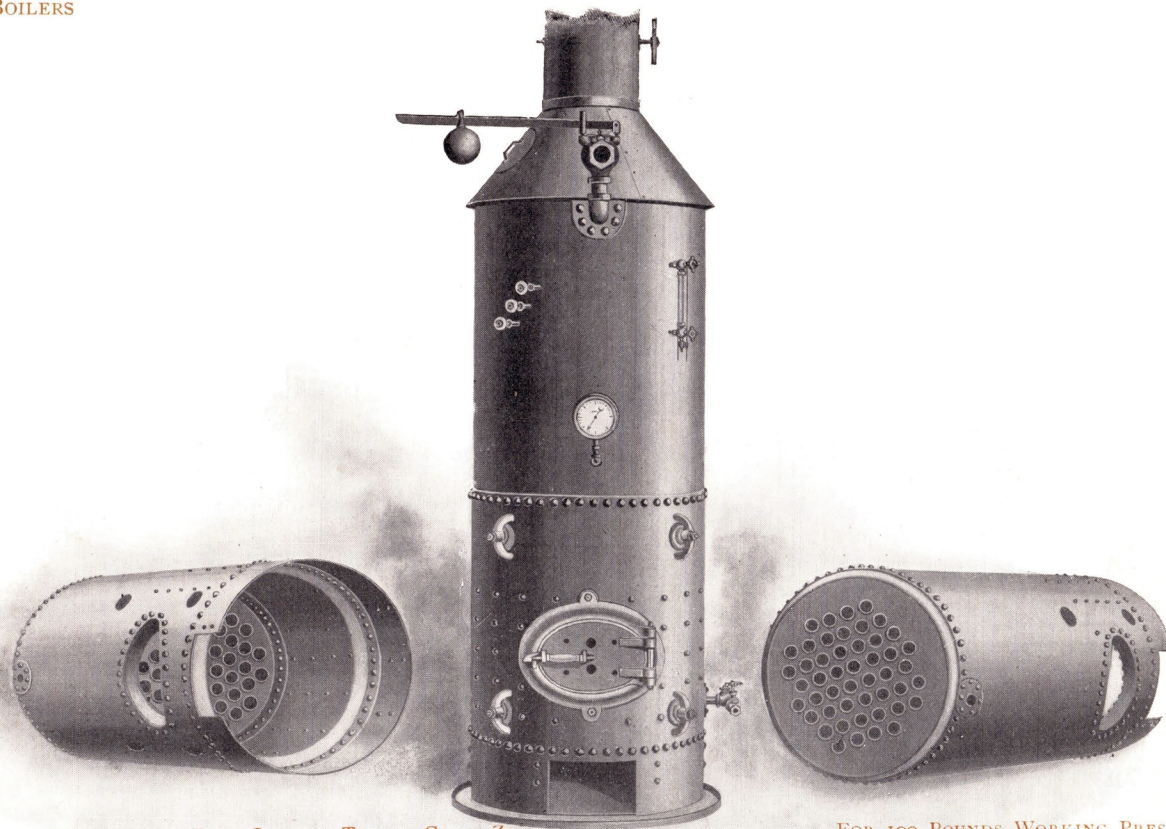
Each Boiler is mounted on Skids and furnished with Dome, Grate Bars, Pop Safety Valve, Steam Gage and Siphon, Water Column and Connections, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Blow-off Cock, Smoke Stack and Guy Wire Cable four times the length of Stack.

Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note— Dry Pipe without Dome, can be furnished if preferred.

All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company, furnished with each Boiler.



ATLAS VERTICAL BOILER WITH FULL LENGTH TUBES—CLASS Z

FOR 100 POUNDS WORKING PRESSURE

Atlas Vertical Boilers—Class Z

With Full Length Tubes

For 100 Pounds Working Pressure

SPECIFICATIONS

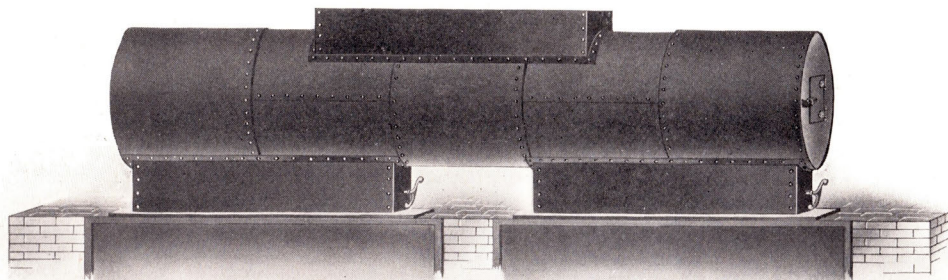
Estimate Number	Nominal Horse Power Rating	Shell		Fire Box		Mean Thickness		Size of Steam Outlet	Tubes			Total Heating Surface	Stack		Shipping Weight Pounds Approximate		
		Diameter	Height Over All	Diameter	Height	Shell	Heads		Number	Diameter	Length		Diameter	Length	Boiler Only	Fixtures Only	Boiler and Fixtures
		Inches	Ft. In.	Inches	Inches	Inches	Inches	Inches		Inches	Ft. In.	Sq. Ft.	Inches	Feet			
6Z	6	28	5 10	23½	27	¼	⅜	1¼	42	2	2 8	75	10	15	1209	391	1600
8Z	8	30	6 5	25½	27	¼	⅜	1½	48	2	3 3	99	12	15	1446	454	1900
10Z	10	30	7 4	25½	27	¼	⅜	1½	48	2	4 2	122	12	20	1593	507	2100
15Z	15	34	7 8	29½	27	¼	⅜	2	70	2	4 6	186	14	25	2058	642	2700
20Z	20	36	8 9	31½	27	¼	⅜	2	76	2	5 7	245	15	25	2645	755	3400
25Z	25	38	9 3	33½	27	¼	⅜	2½	88	2	6 1	304	16	30	3153	947	4100

Each Boiler is furnished with Cast Base Plate, Grate Bars, Pop Safety Valve, Steam Gage, Glass Water Gage and Gage Cocks, Check Valve, Stop Valve, Blow-off Cock, Smoke Stack, Hood and Guy Wire Cable four times the length of Stack.

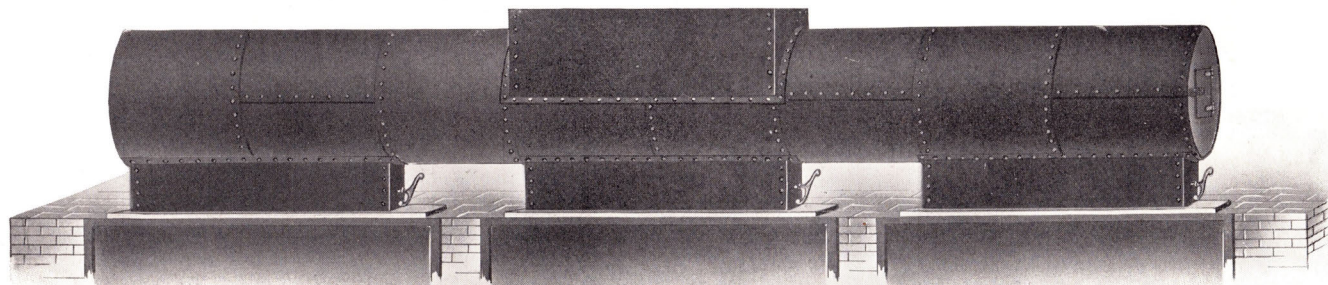
Delivered on cars at our Works in Indianapolis.

Everything furnished with above Outfits is particularly mentioned in the Specifications. Anything else ordered will be charged for extra.

Note—All Plate is Flange Steel, guaranteed by the makers to be 60,000 pounds tensile strength and to turn down double cold without fracture. Certificate of Inspection by the Hartford Steam Boiler Inspection and Insurance Company furnished with each Boiler.



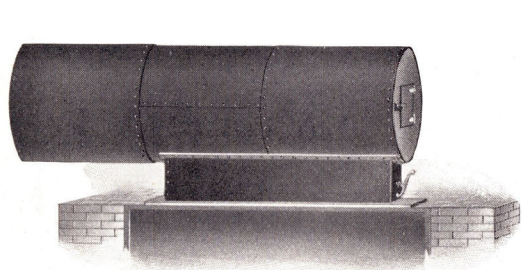
DOUBLE STANDARD SMOKE CONNECTION WITH STACK SADDLE



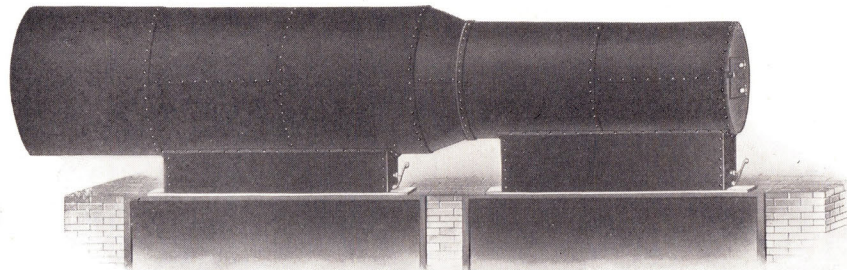
TRIPLE STANDARD SMOKE CONNECTION WITH STACK SADDLE

ATLAS SMOKE CONNECTIONS OR BREECHINGS

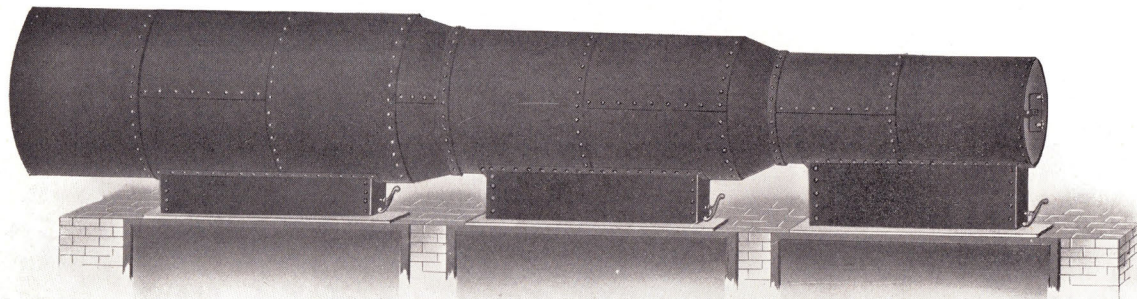
On this and the succeeding page several Standard Smoke Connections or Breechings are shown. They are suitable for nearly all occasions. Special breechings will of course be built of any required size or shape.



SINGLE SIDE SMOKE CONNECTION

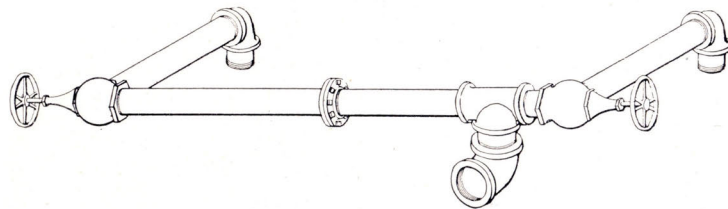


DOUBLE TELESCOPE SMOKE CONNECTION

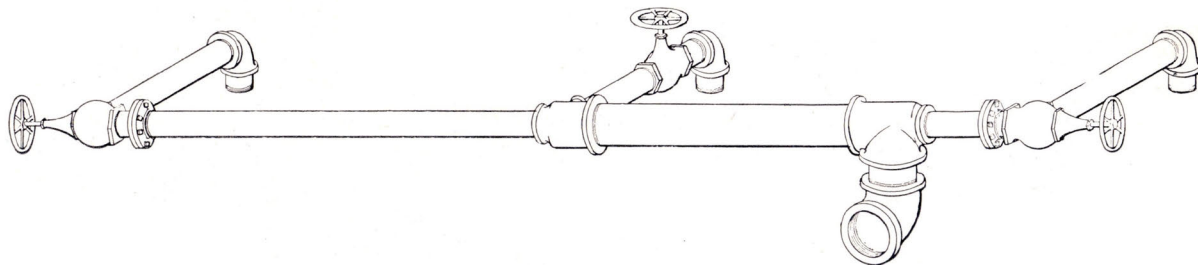


TRIPLE TELESCOPE SMOKE CONNECTION

ATLAS SMOKE CONNECTIONS OR BRERCHINGS



DOUBLE STEAM CONNECTIONS BETWEEN BOILERS, WITH CUT-OFF VALVES



TRIPLE STEAM CONNECTIONS BETWEEN BOILERS, WITH CUT-OFF VALVES

Directions for Setting Stationary Tubular Boilers

Complete detailed foundation and setting plans are furnished free of cost, from which any competent mason can readily erect the masonry setting, yet a few general remarks relative to handling and installing stationary tubular boilers may be of some assistance.

In unloading the boiler from a car, and in moving it to its intended location, great care should be exercised to avoid straining or jarring. Too frequently this work is not properly supervised, and the ignorance or indifference of the workmen causes annoying and expensive leaks in the boiler when it is fired up. Such practices as dropping the boiler from a car, allowing it to roll down an incline without being under the control of ropes and tackle, or shifting and raising it by means of an iron bar inserted in the tubes, should not be tolerated.

The standard plans contemplate an excavation 24 inches deep for the foundation, which is ample unless the soil is unfirm, in which case some provision must be made to secure a really substantial footing. When the foundation has been built the boiler may be blocked up 3 or 4 inches higher than its ultimate position, and the side and end walls (also the middle walls if multiple setting) carried up to the proper height to support the wings when the boiler is lowered to its seat. Headers should be left in the side walls so that the bridge and cross walls may be tied to them. If the boiler is to be supported upon a backstand, the blocking should be located so that the back cross wall and standpier can be built at the same time as the side and end walls. It is well to prop the fire front up absolutely plumb and in its final position and allow it to remain there while building the front-end wall, locating and imbedding the anchor bolts as the wall progresses. The work should then be allowed to stand a sufficient time for the walls to settle and harden, say six or eight days. When the walls are dry, the boiler should be lowered into place, the blocking removed and the walls completed. When set with a half or three-quarter arch front, the smoke box should project 9 inches beyond the front wall, so that the fire front lining may lap the front boiler head and afford protection from the fire. It is advisable to leave an air space between the inside and outside walls, in order that the inside wall may expand and contract freely

without injury to the outside of the setting. In building these walls, a row of headers should be laid in every sixth course of the outside walls, so that the ends of the bricks will come up against the inner walls, but the walls should not be tied together. At the height shown on the setting plans the side walls should be racked in to the shell of boiler. The combustion chamber at the rear is to be covered at the top by firebrick, supported on skeleton arch-bars, which rest with one end on the rear wall and the other on an angle-iron attached to the boiler head. The skeleton arch bars form part of the standard fittings, and allow the covering to be very readily removed when occasion requires it.

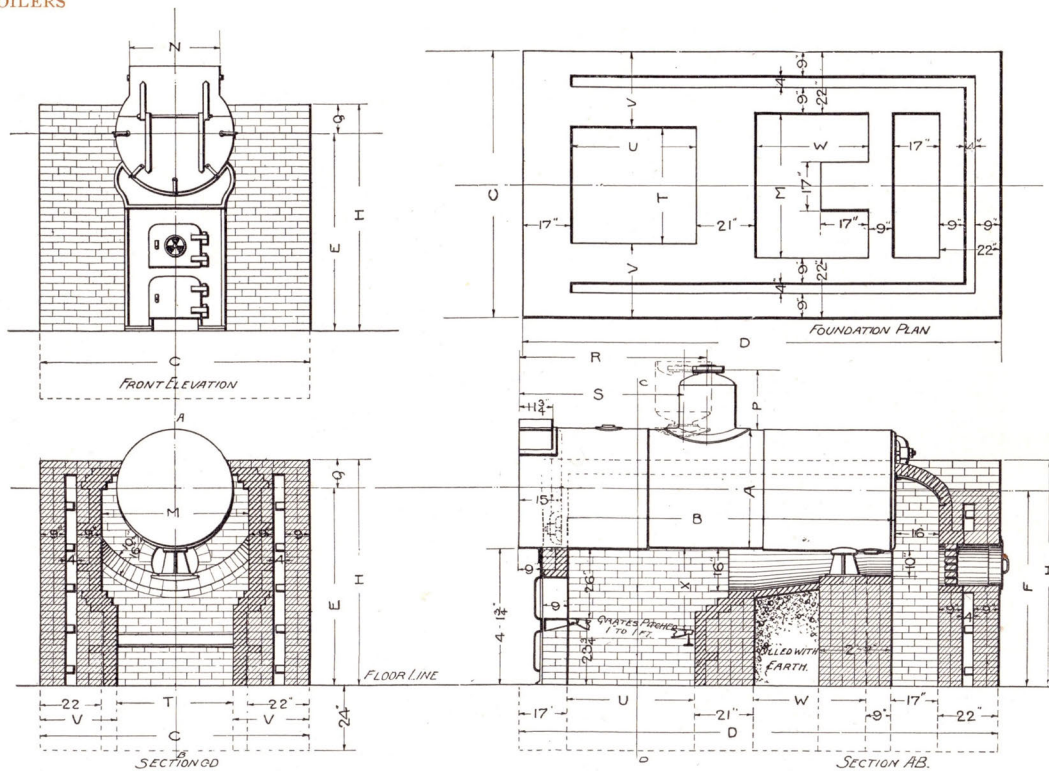
When the plans are followed, and the space between the two cross walls back of the soot pit are filled with earth and then covered by one course of firebrick the heat is kept close to the boiler shell. It is also good practice to build a baffling shield of firebrick in front of the blow-off pipe, preferably in the form of the letter V, with the point towards the fire.

The firebrick which line the furnace should be laid in good fire clay, in such a manner that repairs may be made at any time, without disturbing the main walls. Whether the foundation is of brick or stone, it is best to lay it in Portland cement on account of its imperviousness to frost or moisture. The portion of the walls above the floor line can safely be laid in Louisville cement, or its equal. In starting up the boiler a very slow fire should be built under it and continued if possible for at least two days in order that the boiler and the walls may be very gradually warmed up to the point where a fierce fire will not cause injury.

Materials for Standard Stationary Boiler Settings

Size of Boilers	Single Setting						Double Independent Setting						Each Additional Boiler					
	Common Brick	Fire Brick	Sand	Cement	Lime	Fire Clay	Common Brick	Fire Brick	Sand	Cement	Lime	Fire Clay	Common Brick	Fire Brick	Sand	Cement	Lime	Fire Clay
	In. Ft.		Yards	Barrels	Bushels	Pounds			Yards	Barrels	Bushels	Pounds			Yards	Barrels	Bushels	Pounds
36 x 8	7400	800	3	7½	10¼	480	11500	1600	4½	11½	16	960	4100	800	1½	4	5¾	480
36 x 10	8400	850	3¼	8½	11¾	510	12800	1700	5	12¾	18	1020	4400	850	1¾	4¼	6¼	510
36 x 12	9700	900	3¾	9¾	13½	540	14400	1800	5¾	14½	20	1080	4700	900	2	4¾	6½	540
40 x 12	10100	950	4	10	14	570	15000	1900	6	15	21	1140	4900	950	2	5	7	570
42 x 12	10200	950	4	10¼	14¼	570	15300	1900	6¼	15¼	21½	1140	5100	950	2¼	5	7¼	570
46 x 12	10600	1050	4¼	10½	14¾	630	16000	2100	6¾	16	22½	1260	5400	1050	2½	5½	7¾	630
46 x 20	16400	1500	6½	16½	23	900	24800	3000	10	24¾	34¾	1800	8400	1500	3½	8¼	11¾	900
48 x 12	10800	1100	4¼	10¾	15	660	16400	2200	6½	16½	23	1320	5600	1100	2¼	5¾	8	660
48 x 14	13200	1250	5¼	13¼	18½	750	20400	2500	8	20½	28½	1500	7200	1250	2¾	7¼	10	750
48 x 20	16600	1650	6¾	16½	23¼	990	25500	3300	10¼	25½	35¾	1980	8900	1650	3½	9	12½	990
52 x 14	13600	1350	5½	13½	19	810	21100	2700	8½	21	29½	1620	7500	1350	3	7½	10½	810
54 x 14	13800	1450	5½	13¾	19¼	870	21600	2900	8¾	21½	30¼	1740	7800	1450	3¼	7¾	11	870
54 x 16	15000	1600	6	15	21	960	23300	3200	9½	23¾	32¾	1920	8300	1600	3½	8¼	11¾	960
56 x 20	17500	1850	7	17½	24½	1100	26900	3700	10¾	27	37½	2200	9400	1850	3¾	9½	13	1100
60 x 14	14400	1600	5¾	14½	20	960	22500	3200	9	22½	31½	1920	8100	1600	3¼	8	11½	960
60 x 16	15900	1750	6¼	16	21½	1050	24400	3500	9¾	24½	34	2100	8500	1750	3½	8½	12½	1050
60 x 20	18200	1950	7¼	18¼	25½	1170	28300	3900	11½	28¼	39½	2340	10100	1950	4¼	10	14	1170
66 x 16	16300	2000	6½	16¼	23	1200	25300	4000	10	25¼	35½	2400	9000	2000	3½	9	12½	1200
66 x 20	19000	2250	7½	19	26½	1350	29300	4500	11¾	29¼	41	2700	10300	2250	4¼	10¼	14½	1350
72 x 16	16900	2200	6¾	17	23¾	1320	26100	4400	10½	26	36½	2640	9200	2200	3¾	9	12¾	1320
72 x 18	18100	2400	7¼	18	25½	1440	27300	4800	11	27¼	38¼	2880	9200	2400	3¾	9¼	12¾	1440
72 x 20	20000	2550	8	20	28	1530	31300	5100	12½	31¼	43¾	3060	11300	2550	4½	11¼	15¾	1530

Note—The above figures are based on 18 brick per cubic foot.



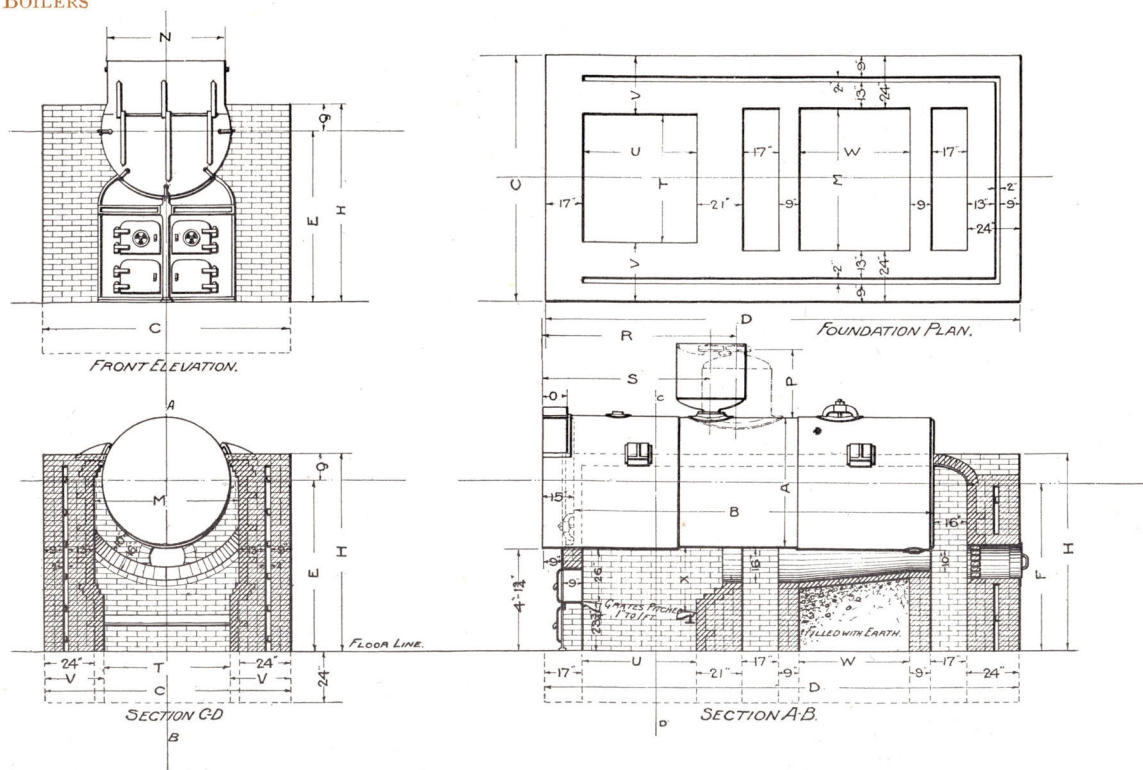
SINGLE SETTINGS—HORIZONTAL TUBULAR BOILERS WITH HENRY B FRONTS

(HENRY C OR THREE-QUARTER FRONTS MAY BE SUBSTITUTED WITHOUT CHANGING DIMENSIONS)

Dimensions for Single Settings of Horizontal Tubular Boilers With Henry B Fronts

Size of Boiler			REFERENCE LETTER															
Dimen- sions A	Dimen- sions B		C	D	E	F	H	M	N	P	Q	R	S	T	U	V	W	X
	Ft.	In.																
36	8	0	90	12 4	68	67	76	46	20	20	8	72	72	36	25	27	37	28
36	10	0	90	14 4	68	67	76	46	20	20	8	78	86	36	31	27	55	28½
36	12	0	90	16 4	68	67	76	46	20	20	8	78	86	36	37	27	73	29
40	12	0	94	16 4	70	69	79	50	26	22	9	78	86	42	43	26	67	29½
42	12	0	96	16 4	71	70	81	52	32	22	10	78	86	42	49	27	61	30
46	12	0	100	16 4	73	72	84	56	32	24	11	78	86	48	49	26	61	30
48	12	0	102	16 4	74	73	85	58	42	24	11	78	86	48	49	27	61	30

Note—All dimensions stated in inches except where otherwise noted.
See complete table of Setting Materials on page 45.



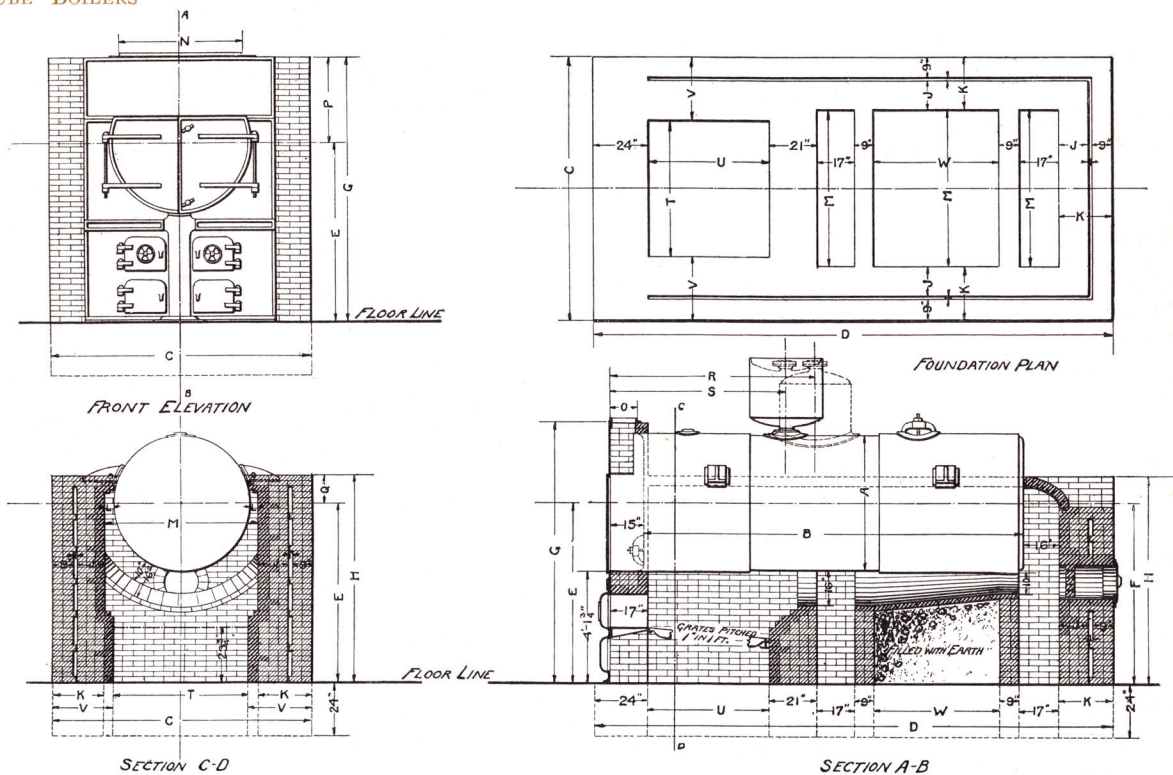
SINGLE SETTINGS—HORIZONTAL TUBULAR BOILERS WITH HENRY C FRONTS
(THREE-QUARTER FRONTS MAY BE SUBSTITUTED WITHOUT CHANGING DIMENSIONS)

Dimensions for Single Settings of Horizontal Tubular Boilers With Henry C Fronts.

Size of Boiler		REFERENCE LETTER																	
Dimen- sion	Dimen- sion	C	D		E	F	H	M	N	O	P	Q	R	S	T	U	V	W	X
A	B Ft. In.		Ft.	In.															
46	20 0	100	24	6	73	72	84	52	32	11 ⁵ / ₈	24	11	126	114	48	49	26	131	30
48	14 0	102	18	6	74	73	87	54	42	11 ⁵ / ₈	24	13	91	78	48	55	27	53	30 ¹ / ₂
48	20 0	102	24	6	74	73	87	54	42	11 ⁵ / ₈	24	13	126	114	48	55	27	125	30 ¹ / ₂
52	14 0	108	18	6	76	75	87	60	45	11 ¹ / ₄	26	11	91	78	48	55	30	53	30 ¹ / ₂
54	14 0	110	18	6	77	76	89	62	45	11 ¹ / ₄	26	12	91	78	54	55	28	53	30 ¹ / ₂
54	16 0	110	20	6	77	76	91	62	45	11 ¹ / ₄	26	14	102	84	54	55	28	77	30 ¹ / ₂
56	20 0	112	24	6	78	77	91	64	45	11 ¹ / ₄	26	13	126	114	54	55	29	125	30 ¹ / ₂
60	14 0	116	18	6	80	79	93	68	55	11 ¹ / ₄	32	13	91	78	60	55	28	53	30 ¹ / ₂
60	16 0	116	20	6	80	79	91	68	55	11 ¹ / ₄	32	11	102	84	60	55	28	77	30 ¹ / ₂
60	20 0	116	24	6	80	79	95	68	55	11 ¹ / ₄	32	15	126	114	60	55	28	125	30 ¹ / ₂
66	16 0	122	20	6	83	82	96	74	60	11 ¹ / ₄	32	13	102	84	66	55	28	77	30 ¹ / ₂
66	20 0	122	24	6	83	82	96	74	60	11 ¹ / ₄	32	13	126	114	66	55	28	125	30 ¹ / ₂
72	16 0	128	20	6	86	85	100	80	66	11 ¹ / ₄	32	14	102	84	72	61	28	71	31
72	18 0	128	22	6	86	85	100	80	66	11 ¹ / ₄	32	14	114	94	78	61	25	95	31
72	20 0	128	24	6	86	85	103	80	66	11 ¹ / ₄	32	17	126	114	72	61	28	119	31

Note—All dimensions stated in inches except where otherwise noted.
See complete table of Setting Materials on page 45.

ATLAS FIRE-TUBE BOILERS



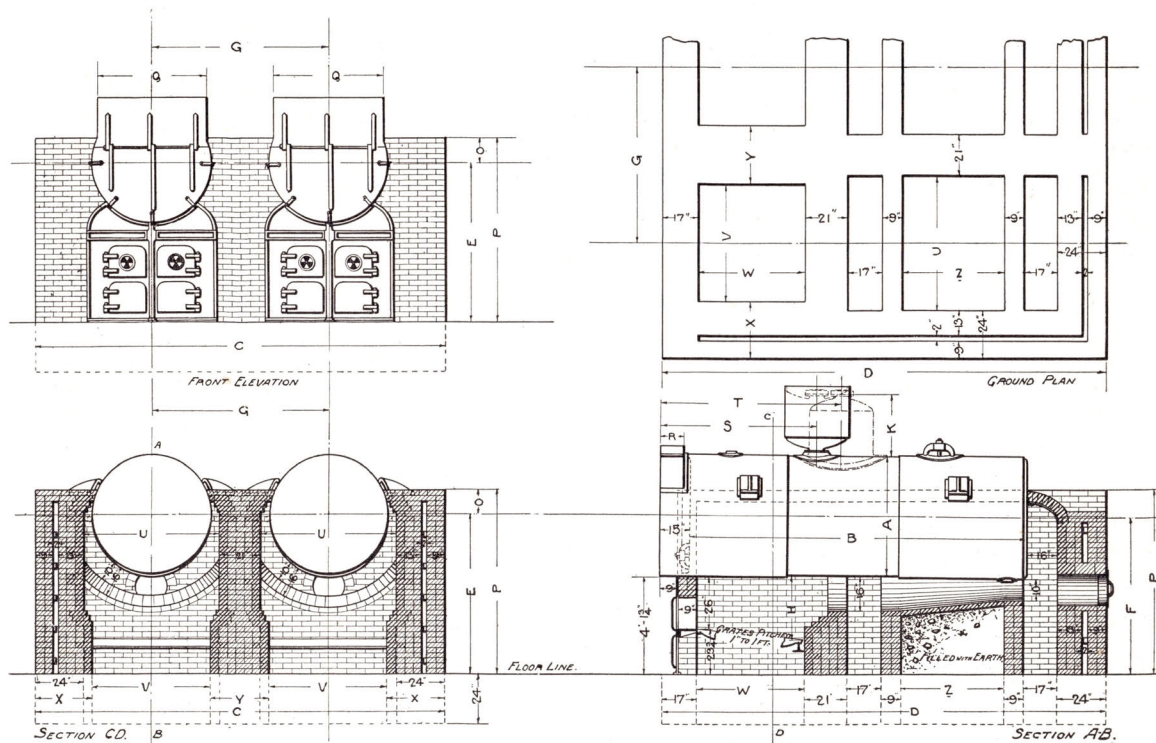
SINGLE SETTINGS—HORIZONTAL TUBULAR BOILERS WITH PLAIN FULL SQUARE FRONTS

(ORNAMENTAL FRONTS MAY BE SUBSTITUTED WITHOUT CHANGING DIMENSIONS)

Dimensions for Single Settings of Horizontal Tubular Boilers With Plain Full Square Fronts

Size of Boiler			REFERENCE LETTER																					
Dimen- sions A	Dimen- sions B		C	D		E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
	Ft.	In.		Ft.	In.																			
36	8	0	90	13	0	68	67	91	76	4	9	22	5	46	20	11 ³ / ₄	23	8	72	72	36	25	27	12
36	10	0	90	15	0	68	67	91	76	4	9	22	5	46	20	11 ³ / ₄	23	8	78	86	36	31	27	30
36	12	0	90	17	0	68	67	91	76	4	9	22	5	46	20	11 ³ / ₄	23	8	78	86	36	37	27	48
40	12	0	94	17	0	70	69	99	79	4	9	22	5	50	26	11 ³ / ₄	29	9	78	86	42	43	26	42
42	12	0	96	17	0	71	70	99	81	4	9	22	5	52	32	11 ³ / ₄	28	10	78	86	42	49	27	36
46	12	0	100	17	0	73	72	99	84	4	9	22	5	56	32	11 ³ / ₄	26	11	78	86	48	49	26	36
46	20	0	100	25	2	73	72	99	84	2	13	24	3	52	32	11 ³ / ₄	26	11	126	114	48	49	26	132
48	12	9	102	17	0	74	73	99	85	4	9	22	5	58	42	11 ³ / ₄	25	11	78	86	48	49	27	36
48	14	0	102	19	2	74	73	99	87	2	13	24	3	54	42	11 ³ / ₄	25	13	91	78	48	55	27	54
48	20	0	102	25	2	74	73	99	87	2	13	24	3	54	42	11 ³ / ₄	25	13	126	114	48	55	27	126
52	14	0	108	19	2	76	75	113	87	2	13	24	4	60	45	11 ³ / ₈	37	11	91	78	48	55	30	54
54	14	0	110	19	2	77	76	113	89	2	13	24	4	62	45	11 ³ / ₈	36	12	91	78	54	55	28	54
54	16	0	110	21	2	77	76	113	91	2	13	24	4	62	45	11 ³ / ₈	36	14	102	84	54	55	28	78
56	20	0	112	25	2	78	77	113	91	2	13	24	4	64	45	11 ³ / ₈	35	13	126	114	54	55	29	126
60	14	0	116	19	2	80	79	116	93	2	13	24	4	68	55	11 ³ / ₈	36	13	91	78	60	55	28	54
60	16	0	116	21	2	80	79	116	91	2	13	24	4	68	55	11 ³ / ₈	36	11	102	84	60	55	28	78
60	20	0	116	25	2	80	79	116	95	2	13	24	4	68	55	11 ³ / ₈	36	15	126	114	60	55	28	126
66	16	0	122	21	2	83	82	120	96	2	13	24	4	74	60	11 ³ / ₈	37	13	102	84	66	55	28	78
66	20	0	122	25	2	83	82	120	96	2	13	24	4	74	60	11 ³ / ₈	37	13	126	114	66	55	28	126
72	16	0	128	21	2	86	85	128	100	2	13	24	4	80	66	11 ³ / ₈	42	14	102	84	72	61	28	72
72	18	0	128	23	2	86	85	128	100	2	13	24	4	80	66	11 ³ / ₈	42	14	114	94	78	61	25	96
72	20	0	128	25	2	86	85	128	103	2	13	24	4	80	66	11 ³ / ₈	42	17	126	114	72	61	28	120

Note—All dimensions stated in inches except where otherwise noted.
See complete table of Setting Materials on page 45.



DOUBLE INDEPENDENT SETTINGS—HORIZONTAL TUBULAR BOILERS WITH HENRY C FRONTS
(THREE-QUARTER FRONTS MAY BE SUBSTITUTED WITHOUT CHANGING DIMENSIONS)

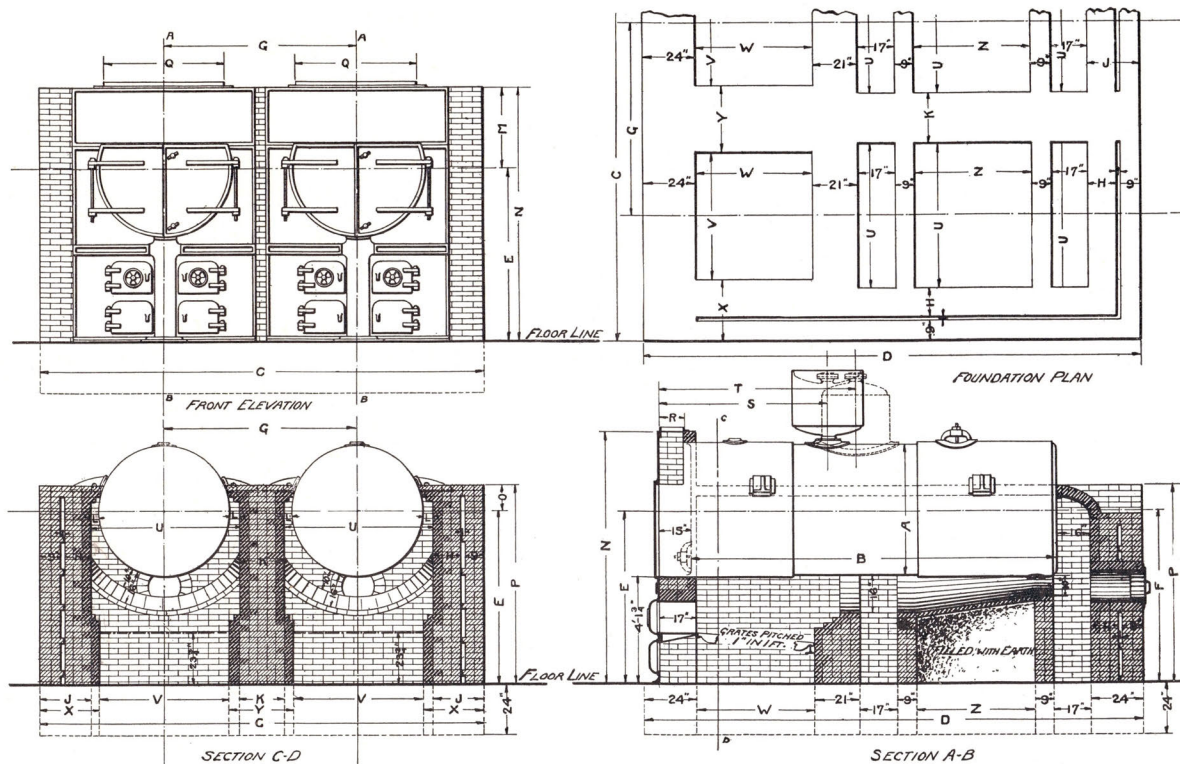
Dimensions for Double Independent Settings of Standard Tubular Boilers With Henry C Fronts

Size of Boiler			REFERENCE LETTER																				
Dimension A	Dimension B		C		D		E	F	G	H	K	O	P	Q	R	S	T	U	V	W	X	Y	Z
	Ft.	In.	Ft.	In.	Ft.	In.																	
46	20	0	14	5	24	6	73	72	73	30	24	11	84	32	11 5/8	114	126	52	48	49	26	25	131
48	14	0	14	10	18	6	74	73	76	30 1/2	24	13	87	42	11 5/8	78	91	54 1/2	48	55	27	28	53
48	20	0	14	10	24	6	74	73	76	30 1/2	24	13	87	42	11 5/8	114	126	54 1/2	48	55	27	28	125
52	14	0	15	9	18	6	76	75	81	30 1/2	26	11	87	45	11 1/4	78	91	60	48	55	30	33	53
54	14	0	16	1	18	6	77	76	83	30 1/2	26	12	89	45	11 1/4	78	91	62	54	55	28	29	53
54	16	0	16	1	20	6	77	76	83	30 1/2	26	14	91	45	11 1/4	84	102	62	54	55	28	29	77
56	20	0	16	5	24	6	78	77	85	30 1/2	26	13	91	45	11 1/4	108	126	64	54	55	29	31	125
60	14	0	17	1	18	6	80	79	89	30 1/2	32	13	93	55	11 1/4	78	91	68	60	55	28	29	53
60	16	0	17	1	20	6	80	79	89	30 1/2	32	11	91	55	11 1/4	84	102	68	60	55	28	29	77
60	20	0	17	1	24	6	80	79	89	30 1/2	32	15	95	55	11 1/4	114	126	68	60	55	28	29	125
66	16	0	18	1	20	6	81	82	95	30 1/2	32	13	96	60	11 1/4	84	102	74	66	55	28	29	77
66	20	0	18	1	24	6	83	82	95	30 1/2	32	13	96	60	11 1/4	114	126	74	66	55	28	29	125
72	16	0	19	1	20	6	86	85	101	31	32	14	100	66	11 1/4	84	102	80	72	61	28	29	71
72	18	0	19	1	22	6	86	85	101	31	32	14	100	66	11 1/4	94	114	80	78	61	25	23	95
72	20	0	19	1	24	6	86	85	101	31	32	17	103	66	11 1/4	114	126	80	72	61	28	29	119

Note—All dimensions stated in inches, except where otherwise noted.

See complete tables of Setting Materials on page 45.

When more than two boilers are to be set in Standard Independent Setting, the total width of setting is ascertained by adding to the dimension "C" the dimension "G" for each additional boiler. Thus, four 66" boilers will occupy a total width of $18' 1" + 95" + 95" = 33' 11"$



DOUBLE INDEPENDENT SETTINGS—HORIZONTAL TUBULAR BOILERS WITH FULL SQUARE FRONTS

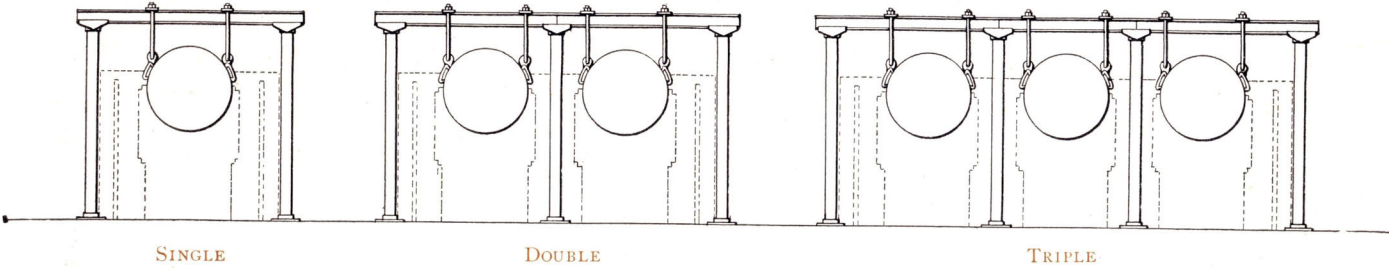
(ORNAMENTAL FRONTS MAY BE SUBSTITUTED WITHOUT CHANGING DIMENSIONS)

Dimensions for Double Settings of Standard Tubular Boilers with Plain Full Square Fronts

Size of Boiler			REFERENCE LETTER																											
Dim'sions	Dimensions		C		D		E	F	G	H	I	J	K	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			
A	B		Ft. In.		Ft. In.																									
	Ft.	In.	Ft.	In.	Ft.	In.																								
36	8	0	12	9	13	0	68	67	63	9	4	22	17	23	91	8	76	20	11¾	72	72	46	36	25	27	27	12			
36	10	0	12	9	15	0	68	67	63	9	4	22	17	23	91	8	76	20	11¾	86	78	46	36	31	27	27	30			
36	12	0	12	9	17	0	68	67	63	9	4	22	17	23	91	8	76	20	11¾	86	78	46	36	37	27	27	48			
40	12	0	13	5	17	0	70	69	67	9	4	22	17	29	99	9	79	26	11¾	86	78	50	42	43	26	25	42			
42	12	0	13	9	17	0	71	70	69	9	4	22	17	28	99	10	81	32	11¾	86	78	52	42	49	27	27	36			
46	12	0	14	5	17	0	73	72	73	9	4	22	17	26	99	11	84	32	11¾	86	78	56	48	49	26	25	36			
46	20	0	14	5	25	2	73	72	73	13	2	24	21	26	99	11	84	32	11¾	114	126	52	48	49	26	25	132			
48	12	0	14	10	17	0	74	73	76	9	4	22	17	25	99	11	85	42	11¾	86	78	58	48	49	27	28	36			
48	14	0	14	10	19	2	74	73	76	13	2	24	21	25	99	13	87	42	11¾	78	91	54½	48	55	27	28	54			
48	20	0	14	10	25	2	74	73	76	13	2	24	21	25	99	13	87	42	11¾	114	126	54½	48	55	27	28	126			
52	14	0	15	9	19	2	76	75	81	13	2	24	21	37	113	11	87	45	11⅜	78	91	60	48	55	30	33	54			
54	14	0	16	1	19	2	77	76	83	13	2	24	21	36	113	12	89	45	11⅜	78	91	62	54	55	28	29	54			
54	16	0	16	1	21	2	77	76	83	13	2	24	21	36	113	14	91	45	11⅜	84	102	62	54	55	28	29	78			
56	20	0	16	5	25	2	78	77	85	13	2	24	21	35	113	13	91	45	11⅜	114	126	64	54	55	29	31	126			
60	14	0	17	1	19	2	80	79	89	13	2	24	21	36	116	13	93	55	11⅜	78	91	68	60	55	28	29	54			
60	16	0	17	1	21	2	80	79	89	13	2	24	21	36	116	11	91	55	11⅜	84	102	68	60	55	28	29	78			
60	20	0	17	1	25	2	80	79	89	13	2	24	21	36	116	15	95	55	11⅜	114	126	68	60	55	28	29	126			
66	16	0	18	1	21	2	83	82	95	13	2	24	21	37	120	13	96	60	11⅜	84	102	74	66	55	28	29	78			
66	20	0	18	1	25	2	83	82	95	13	2	24	21	37	120	13	96	60	11⅜	114	126	74	66	55	28	29	126			
72	16	0	19	1	21	2	86	85	101	13	2	24	21	42	128	14	100	66	11⅜	84	102	80	72	61	28	29	72			
72	18	0	19	1	23	2	86	85	101	13	2	24	21	42	128	14	100	66	11⅜	94	114	80	78	61	25	23	96			
72	20	0	19	1	25	2	86	85	101	13	2	24	21	43	128	17	103	66	11⅜	114	126	80	72	61	28	29	120			

Note—All dimensions stated in inches, except where otherwise noted. See complete table of Setting Materials on page 45.

When more than two boilers are to be set in Standard Independent Setting, the total width of setting is ascertained by adding to the dimension "C" the dimension "G" for each additional boiler. Thus, four 66" boilers will occupy a total width of $18' 1'' + 95'' + 95'' = 33' 11''$.



Suspension Apparatus

In cases where it has been desirable to support the boiler or boilers independently of the brickwork the method of suspension shown above has been found suitable and owing to its popularity the necessary parts are usually carried in stock. The upright columns are made from wrought iron piping, the substantial caps and bases being cast iron. Standard I beams, one over the front and one over the rear end of each boiler, are fitted into the caps and bolted into place, each boiler being suspended by means of four weldless round iron U bolts. The ends of each bolt are run through a thick piece of steel plate, which rests on the I beam, being made fast and adjustable for height by nuts and washers to allow the taking up of any settling in the foundations. The usual cast iron wings or lugs on the boilers are replaced with slip-loops, as illustrated. In case of battery setting without division walls, or if preferred for any other reason, the I beams can be supplied in single lengths to extend the full width of the double and triple settings, thus doing away with the columns in the division walls. For the longer spans heavier and more expensive beams are of course required.

The additional weight of the suspension apparatus here illustrated over and above the usual shipping weight of each boiler is about as follows:

Diameter of Boiler.....	36	40	42	46	48	52	54	60	66	72
One Boiler	1146	1172	1236	1264	1288	1385	1421	1930	2067	2325
Each Additional Boiler.....	706	722	781	799	818	905	936	1235	1332	1570

To the weight of the 48" x 12' and smaller boilers, not usually equipped with wings, 400 lbs. per boiler should also be added to cover the weight of the loops and bolts.

Care and Management of Boilers

The first care of the engineer or fireman should be the height of water in the boiler, and, as the water gage and its connections may be clogged, he should not depend absolutely upon the level of the water in the glass. The gage cocks should be tried to ascertain positively that there is at least two inches of water over the tubes or crown sheet before unbanking or replenishing the fire. Accidents have occurred involving heavy loss of life and the destruction of property simply from neglect of this precaution.

In cases of low water the fire should be immediately covered with ashes or slack, and the ash pit doors closed. If wood is being used as a fuel the fire should be withdrawn and the fire doors thrown open. The feed should not under any circumstances be turned on, nor the safety-valve opened. The steam outlets and feed should not be touched until the pressure has fallen to the point where it is entirely safe to open the feed.

Should the water in the boiler be foaming the throttle should be closed long enough to show the true water level and if that level is sufficiently high to allow of feeding and blowing the evil can usually be corrected. In cases of violent foaming caused by dirty water the draft should also be checked, and the fires covered with fresh coal.

Boilers should be emptied and cleaned out at least once every two weeks, and every week if possible. If the feed water is muddy a blowdown of a few inches should be made every day. Boilers should never be emptied while hot, as the walls, plates, tubes and braces retain sufficient heat to bake the deposits of mud into a hard scale that adheres firmly and with the masonry hot there is danger of injury to the plates. If the boiler and walls are allowed to cool down before the water is run out the sediment will be quite soft and is easily washed out with a hose. A good plan is to withdraw the fire the evening before cleaning day and allow the water to remain in the boiler over night, opening the man and hand-holes to wash out just as soon as the boiler is empty. At intervals the interior of the boiler should be gone over with a hammer to detect any weakness or injury in the plates, tubes or braces.

Care should be taken that no water, either from leaky joints or other causes, comes in contact with the exterior of the boiler. All sheets and other parts exposed to the fire should be kept perfectly clean, and all tubes, flues and connections well swept. Care in this respect is particularly necessary where wood or soft coal is used for fuel.

If leaks or blisters are discovered they should be examined at once by some competent person and steps taken for their immediate repair.

The pop safety valve should be inspected frequently, and the pressure at which it blows off should correspond exactly with that indicated by the steam gage. The valve should be opened frequently, though cautiously, by hand, to be certain that it is in good working order. If the valve is of the ball and lever type no additional weights should ever be put on the lever.

The water column and its connections should be examined quite often to detect possible choking with dirt. The connections are made with crosses fitted with plugs, and the piping can be very easily cleaned.

Atlas Stationary Tubular boilers are fitted with an internal feed pipe entering through the front head and extending along one side of the shell to within 2 feet of the rear head, thence across the boiler, discharging downward between the tubes and the shell. With the pipe arranged in this manner the feed water is thoroughly heated before it is discharged into the boiler and no injury to plate or tubes can result. The connection to the feed pipe at the front end is by means of a cross fitted with plugs, so that cleaning is a simple matter. The whole pipe can be taken out, examined and replaced in a short time and this should be done often enough to insure always a clear passage of an ample supply of water through the pipe.

The most efficient coal fire is one spread thinly and uniformly over the entire grate surface. A fire should never be allowed to bank up at the front end of the grate, as it is not only a misuse of the coal, but prevents proper circulation of air, and so tends to burn the grate bars, liners, etc. It is best to fire often and little at a time, distributing the fuel evenly over the grates. The ash pit should be kept free of ashes so as to give an absolutely unimpaired draft.

In preparing to raise steam after the boilers have been open or out of service, great care should be exercised in making

the manhole and handhole joints. The safety valve should then be blocked open to allow the air to escape as the boiler becomes filled with water, which should be pumped until it shows at the second gage. The dampers should then be opened and the fires started, some oily waste or kindling being burnt at the base of the stack if it is cold and does not draw properly. The fires should be started in ample time so that it will not be necessary to urge them unduly. When steam begins to issue from the safety-valve it should be carefully closed and attention given to the steam gage. If there are other boilers in operation and stop valves must be opened to place them in connection on a steam pipe line, the pressure of those recently fired should be watched carefully until it is the same as the others, after which the separating valves may be slowly and carefully opened.

Standard Manhole and Tube Arrangements

Showing also Special Tube Arrangements that are Possible Without Interfering with Circulation,
Regular Steam Space, or Usual Manholes

CLASSES L. M. AND N. BOILERS

Size of Boiler	36 x 8	36 x 10	36 x 12	40 x 12	42 x 12	46 x 12	48 x 12	48 x 14
Handholes below tubes, both heads	4½ x 6½	4½ x 6½	4½ x 6½	4½ x 6½	4½ x 6½	0	0	0
Manhole below tubes, front head	0	0	0	0	0	9 x 15	10 x 15½	10 x 15½
Manhole above tubes, back head	9 x 15	9 x 15	9 x 15	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½
Number of 3-inch tubes	24	24	24	30	36	42	48	48
Number of 3½-inch tubes	20	20	20	24	28	32	36	36
Number of 4-inch tubes	..	..	16	20	20	24	28	28
Size of Boiler	52 x 14	54 x 14	54 x 16	60 x 14	60 x 16	66 x 16	72 x 16	72 x 18
Manhole below tubes, front head	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½
Manhole above tubes, top of shell	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	12 x 15½	12 x 15½	12 x 15½
Number of 3-inch tubes	50	54	54	72	72	88	110	..
Number of 3½-inch tubes	40	44	44	54	54	66	86	86
Number of 4-inch tubes	32	36	36	44	44	54	70	70

CLASS V.

CLASS X.

Size of Boiler	48 x 14	54 x 14	54 x 16	60 x 16	66 x 16	72 x 16	72 x 18	54 x 16	60 x 16	66 x 16	72 x 16	72 x 18
Manhole below tubes, front head	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½	10 x 15½
Manhole above tubes, back head	10 x 15½	0	0	0	0	0	0	0	0	0	0	0
Manhole above tubes, top of shell	0	10 x 15½	10 x 15½	10 x 15½	12 x 15½	12 x 15½	12 x 15½	12 x 15½	12 x 15½	12 x 15½	12 x 15½	12 x 15½
Number of 3-inch tubes	48	54	54	72	88	110	..	54	72	88	110	..
Number of 3½-inch tubes	36	44	44	54	66	86	86	44	54	66	86	86
Number of 4-inch tubes	28	36	36	44	54	70	70	36	44	54	70	70

Heavy faced figures in above tables denote Standard Tube Arrangement as per catalogue.

Heating Surface of Boiler Shells and Tubes

In figuring the heating surface in a Tubular Boiler it is customary to consider that two-thirds of the whole shell surface is exposed to the action of the heat as, in setting boilers of this type in masonry, it is the practice to rack in the side walls a few inches below the water line. The whole external surface of the tubes or flues contained in the boiler is considered efficient heating surface. The sum of the shell heating surface and the tube heating surface gives the total area exposed to heat action.

In the table given below is shown two-thirds of the area of boiler shells of different diameters per foot of length and the external area of various size flues or tubes per foot of length. The areas are given in square feet.

Diameter of Boiler—In. Heating Surface of Shell.....Sq. Ft.	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	66	72	78	84
	5.24	5.59	5.93	6.28	6.63	6.98	7.33	7.68	8.03	8.38	8.73	9.08	9.42	9.77	10.12	10.47	11.52	12.57	13.61	14.66
Diameter of Tube or Flue.....In. External Heating Surface.....Sq. Ft.	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4½	5	6	7	8	10	12	14	16	18	20
	.524	.589	.655	.720	.785	.851	.916	.982	1.05	1.18	1.31	1.57	1.83	2.09	2.62	3.14	3.67	4.19	4.71	5.24

Standard Boiler Tubes

Outside Diameter	Inside Diameter	Thickness		Circumference		Transverse Areas			External Heating Surface		Nominal Weight Per Foot
		Inches	Nearest B. W. G.	External Inches	Internal Inches	External Square Inches	Internal Square Inches	Metal Square Inches	Per Foot of Tube Length Square Feet	Tube Length Per Square Foot Feet	
2	1.810	.095	13	6.283	5.686	3.1416	2.5730	.5686	.5236	1.909	1.91
2¼	2.060	.095	13	7.069	6.472	3.9761	3.3329	.6432	.5891	1.698	2.16
2½	2.282	.109	12	7.854	7.169	4.9087	4.0899	.8188	.6545	1.528	2.75
2¾	2.532	.109	12	8.639	7.954	5.9396	5.0349	.9047	.7200	1.389	3.04
3	2.782	.109	12	9.425	8.740	7.0686	6.0787	.9899	.7854	1.273	3.33
3¼	3.010	.120	11	10.210	9.456	8.2958	7.1157	1.1801	.8508	1.175	3.96
3½	3.260	.120	11	10.996	10.242	9.6211	8.3469	1.274	.9163	1.091	4.28
3¾	3.510	.120	11	11.781	11.027	11.045	9.6762	1.369	.9818	1.018	4.60
4	3.732	.134	10	12.566	11.724	12.566	10.939	1.627	1.0472	.955	5.47
4½	4.232	.134	10	14.137	13.295	15.904	14.066	1.838	1.1781	.849	6.17
5	4.704	.148	9	15.708	14.778	19.635	17.379	2.256	1.3090	.764	7.58
6	5.670	.165	8	18.850	17.813	28.274	25.249	3.025	1.5708	.637	10.16
7	6.670	.165	8	21.991	20.954	38.485	34.941	3.544	1.8326	.546	11.90
8	7.670	.165	8	25.133	24.096	50.265	46.204	4.061	2.0944	.477	13.65

Black or Galvanized Standard Weight Pipe

Diameter			Thickness	Circumference		Transverse Area			Nominal Weight Per Foot	Threads Per Inch
Nominal	External	Internal		External	Internal	External	Internal	Metal		
Inches	Inches	Inches	Inches	Inches	Inches	Square Inches	Square Inches	Square Inches	Pounds	
1/8	.405	.269	.068	1.272	.845	.1288	.0568	.0720	.241	27
1/4	.540	.364	.088	1.696	1.144	.2290	.1041	.1249	.42	18
3/8	.675	.493	.091	2.121	1.549	.3578	.1909	.1669	.559	18
1/2	.840	.622	.109	2.639	1.954	.5542	.3039	.2503	.837	14
3/4	1.050	.824	.113	3.299	2.589	.8659	.5333	.3326	1.115	14
1	1.315	1.047	.134	4.131	3.289	1.3581	.8609	.4972	1.668	11 1/2
1 1/4	1.660	1.380	.140	5.215	4.335	2.1642	1.4957	.6685	2.244	11 1/2
1 1/2	1.900	1.610	.145	5.969	5.058	2.8353	2.0358	.7995	2.678	11 1/2
2	2.375	2.067	.154	7.461	6.494	4.4301	3.3556	1.074	3.609	11 1/2
2 1/2	2.875	2.467	.204	9.032	7.750	6.4918	4.7800	1.712	5.739	8
3	3.500	3.066	.217	10.996	9.632	9.6211	7.3827	2.238	7.536	8
3 1/2	4.000	3.548	.226	12.566	11.146	12.566	9.886	2.680	9.001	8
4	4.500	4.026	.237	14.137	12.648	15.904	12.730	3.174	10.665	8
4 1/2	5.000	4.508	.246	15.708	14.162	19.635	15.960	3.675	12.34	8
5	5.563	5.045	.259	17.477	15.849	24.306	19.985	4.321	14.502	8
6	6.625	6.065	.280	20.813	19.054	34.472	28.886	5.586	18.762	8
7	7.625	7.023	.301	23.955	22.063	45.664	38.743	6.921	23.271	8
8	8.625	7.981	.322	27.096	25.073	58.426	50.021	8.405	28.177	8
9	9.625	8.937	.344	30.238	28.076	72.760	62.722	10.04	33.701	8
10	10.750	10.018	.366	33.772	31.472	90.763	78.822	11.94	40.065	8
11	11.750	11.000	.375	36.913	34.558	108.43	95.034	13.40	45.95	8
12	12.750	12.000	.375	40.055	37.699	127.68	113.09	14.59	48.985	8

United States Standard Gauge

Sheet and Plate Iron and Steel

Number of Gauge	Approximate Thickness Fractions of an Inch	Approximate Thickness Decimal Parts of an Inch	Weight per Square Foot Iron Lbs.	Weight per Square Foot Steel Lbs.	Number of Gauge	Approximate Thickness Fractions of an Inch	Approximate Thickness Decimal Parts of an Inch	Weight per Square Foot Iron Lbs.	Weight per Square Foot Steel Lbs.
0000000	$\frac{1}{2}$	.5	20.00	20.4	16	$\frac{1}{16}$	.0625	2.5	2.55
000000	$\frac{1}{8}$	.46875	18.75	19.125	17	$\frac{9}{160}$	.05625	2.25	2.295
00000	$\frac{7}{16}$	.4375	17.50	17.85	18	$\frac{1}{20}$	.05	2.00	2.04
0000	$\frac{13}{32}$	.40625	16.25	16.575	19	$\frac{7}{160}$	.04375	1.75	1.785
000	$\frac{3}{8}$	.375	15.00	15.30	20	$\frac{3}{80}$	.0375	1.50	1.53
00	$\frac{11}{32}$	.34375	13.75	14.025	21	$\frac{11}{320}$	.034375	1.375	1.4025
0	$\frac{5}{16}$	.3125	12.50	12.75	22	$\frac{1}{32}$	.03125	1.25	1.275
1	$\frac{9}{32}$	.28125	11.25	11.475	23	$\frac{9}{320}$	.028125	1.125	1.1475
2	$\frac{17}{64}$	.265625	10.625	10.8375	24	$\frac{1}{40}$	.025	1.00	1.02
3	$\frac{1}{4}$	.25	10.00	10.2	25	$\frac{7}{320}$	.021875	.875	.8925
4	$\frac{15}{64}$	.234375	9.375	9.5625	26	$\frac{3}{160}$	.01875	.75	.765
5	$\frac{7}{32}$	.21875	8.75	8.925	27	$\frac{11}{640}$	.0171875	.6875	.70125
6	$\frac{13}{64}$	.203125	8.125	8.2875	28	$\frac{1}{64}$	.015625	.625	.6375
7	$\frac{3}{16}$	.1875	7.5	7.65	29	$\frac{9}{640}$	.0140625	.5625	.57375
8	$\frac{11}{64}$	.171875	6.875	7.0125	30	$\frac{1}{80}$	.0125	.5	.51
9	$\frac{5}{32}$	.15625	6.25	6.375	31	$\frac{6}{640}$	.0109375	.4375	.44625
10	$\frac{9}{64}$	.140625	5.625	5.7375	32	$\frac{13}{1280}$	.01015625	.40625	.414375
11	$\frac{1}{8}$	.125	5.00	5.1	33	$\frac{3}{320}$	.009375	.375	.3825
12	$\frac{7}{64}$	.109375	4.375	4.4625	34	$\frac{11}{1280}$	.00859375	.34375	.350625
13	$\frac{5}{32}$	.09375	3.75	3.825	35	$\frac{5}{640}$	.0078125	.3125	.31875
14	$\frac{3}{16}$	.078125	3.125	3.1875	36	$\frac{9}{1280}$	.00703125	.28125	.286875
15	$\frac{1}{28}$	.0703125	2.8125	2.86875					

The weights given in the foregoing table are based upon the following: Iron, 481.75 pounds per cubic foot. Steel, 487.75 pounds per cubic foot.

Decimal Equivalents of Common Fractions

Advancing by Sixty-fourths

Common Fractions					Decimal Equivalents	Common Fractions					Decimal Equivalents
4ths	8ths	16ths	32nds	64ths		4ths	8ths	16ths	32nds	64ths	
			$\frac{1}{32}$	$\frac{1}{64}$	.015625					$\frac{33}{64}$	.515625
			$\frac{2}{32}$	$\frac{3}{64}$	.031250				$\frac{17}{32}$		.531250
				$\frac{4}{64}$	.046875					$\frac{35}{64}$	.546875
		$\frac{1}{16}$		$\frac{5}{64}$	.062500			$\frac{9}{16}$			.562500
			$\frac{3}{32}$	$\frac{7}{64}$	.078125					$\frac{37}{64}$	.578125
				$\frac{8}{64}$	.093750				$\frac{19}{32}$		.593750
	$\frac{1}{8}$			$\frac{9}{64}$	.109375					$\frac{39}{64}$	.609375
			$\frac{5}{32}$	$\frac{10}{64}$	.125000		$\frac{3}{8}$				.625000
				$\frac{11}{64}$	.140625					$\frac{41}{64}$	.640625
			$\frac{6}{32}$	$\frac{12}{64}$	.156250				$\frac{21}{32}$		.656250
		$\frac{3}{16}$		$\frac{13}{64}$	.171875					$\frac{43}{64}$	.671875
			$\frac{7}{32}$	$\frac{14}{64}$	.187500			$\frac{11}{16}$			.687500
				$\frac{15}{64}$	.203125					$\frac{45}{64}$	.703125
			$\frac{8}{32}$	$\frac{16}{64}$	.218750				$\frac{23}{32}$		.718750
				$\frac{17}{64}$	.234375					$\frac{47}{64}$	.734375
	$\frac{1}{4}$			$\frac{17}{64}$	.250000	$\frac{3}{4}$					.750000
			$\frac{9}{32}$	$\frac{18}{64}$	.265625					$\frac{49}{64}$	.765625
				$\frac{19}{64}$	.281250				$\frac{25}{32}$		.781250
		$\frac{5}{16}$		$\frac{20}{64}$	.296875					$\frac{51}{64}$	.796875
			$\frac{10}{32}$	$\frac{21}{64}$	.312500			$\frac{13}{16}$			.812500
				$\frac{22}{64}$	.328125					$\frac{53}{64}$	.828125
			$\frac{11}{32}$	$\frac{23}{64}$	.343750				$\frac{27}{32}$		.843750
	$\frac{3}{8}$			$\frac{24}{64}$	.359375					$\frac{55}{64}$	.859375
			$\frac{12}{32}$	$\frac{25}{64}$	.375000		$\frac{7}{8}$				.875000
				$\frac{26}{64}$	.390625					$\frac{57}{64}$	.890625
			$\frac{13}{32}$	$\frac{27}{64}$	.406250				$\frac{29}{32}$		.906250
		$\frac{7}{16}$		$\frac{28}{64}$	.421875					$\frac{59}{64}$	.921875
			$\frac{14}{32}$	$\frac{29}{64}$	.437500			$\frac{15}{16}$			.937500
				$\frac{30}{64}$	.453125					$\frac{61}{64}$	.953125
			$\frac{15}{32}$	$\frac{31}{64}$	.468750				$\frac{31}{32}$		.968750
				$\frac{32}{64}$	.484375					$\frac{63}{64}$	.984375

Circumferences of Circles

Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference
1	.0082	1	3.1416	2	6.2832	3	9.4248	5	15.7080	7	21.9911	11	34.5575	19	59.690	35	109.956	67	210.487
1 $\frac{1}{2}$	.0104	1 $\frac{1}{2}$	3.2398	2 $\frac{1}{2}$	6.3814	3 $\frac{1}{2}$	9.6211	5 $\frac{1}{2}$	15.9043	7 $\frac{1}{2}$	22.1875	11 $\frac{1}{2}$	35.3429	19 $\frac{1}{2}$	61.261	36	113.007	68	213.628
1 $\frac{3}{4}$	.0245	1 $\frac{3}{4}$	3.3379	2 $\frac{3}{4}$	6.4795	3 $\frac{3}{4}$	9.8175	5 $\frac{3}{4}$	16.1007	7 $\frac{3}{4}$	22.7765	11 $\frac{3}{4}$	36.1283	20	62.832	37	116.230	69	216.770
2	.0307	2	3.4361	3	6.5777	4	10.0138	6	16.2970	8	23.1602	12	36.9137	20 $\frac{1}{2}$	64.403	38	119.381	70	219.911
2 $\frac{1}{4}$	.0409	2 $\frac{1}{4}$	3.5343	3 $\frac{1}{4}$	6.6759	4 $\frac{1}{4}$	10.2102	6 $\frac{1}{4}$	16.4934	8 $\frac{1}{4}$	23.5019	12 $\frac{1}{2}$	37.6091	21	65.073	39	122.522	71	223.053
2 $\frac{1}{2}$	.4009	2 $\frac{1}{2}$	3.6325	3 $\frac{1}{2}$	6.7741	4 $\frac{1}{2}$	10.4065	6 $\frac{1}{2}$	16.6897	8 $\frac{1}{2}$	23.9546	12 $\frac{1}{2}$	38.4845	21 $\frac{1}{2}$	67.544	40	125.664	72	226.195
2 $\frac{3}{4}$	.5890	2 $\frac{3}{4}$	3.7306	3 $\frac{3}{4}$	6.8722	4 $\frac{3}{4}$	10.6029	6 $\frac{3}{4}$	16.8861	8 $\frac{3}{4}$	24.3473	12 $\frac{3}{4}$	39.2699	22	69.115	41	128.805	73	229.336
3	.6872	3	3.8288	4	6.9704	5	10.7992	7	17.824	9	24.7400	13	40.8407	22 $\frac{1}{2}$	70.686	42	131.047	74	232.478
3 $\frac{1}{4}$	.8836	3 $\frac{1}{4}$	3.9270	4 $\frac{1}{4}$	7.0686	5 $\frac{1}{4}$	10.9956	7 $\frac{1}{4}$	17.2788	9 $\frac{1}{4}$	25.1327	13 $\frac{1}{2}$	41.6261	23	72.257	43	135.088	75	235.619
3 $\frac{1}{2}$	.9818	3 $\frac{1}{2}$	4.0252	4 $\frac{1}{2}$	7.1668	5 $\frac{1}{2}$	11.1919	7 $\frac{1}{2}$	17.4751	9 $\frac{1}{2}$	25.5254	13 $\frac{1}{2}$	42.4115	23 $\frac{1}{2}$	73.827	44	138.230	76	238.761
3 $\frac{3}{4}$	1.0799	3 $\frac{3}{4}$	4.1233	4 $\frac{3}{4}$	7.2649	5 $\frac{3}{4}$	11.3883	7 $\frac{3}{4}$	17.6715	9 $\frac{3}{4}$	25.9181	13 $\frac{3}{4}$	43.1969	24	75.398	45	141.372	77	241.903
4	1.2763	4	4.2215	5	7.3631	6	11.5846	8	17.8678	10	26.3108	14	43.1969	24 $\frac{1}{2}$	76.969	46	144.513	78	245.044
4 $\frac{1}{4}$	1.4744	4 $\frac{1}{4}$	4.3197	5 $\frac{1}{4}$	7.4613	6 $\frac{1}{4}$	11.7810	8 $\frac{1}{4}$	18.0642	10 $\frac{1}{4}$	26.7035	14 $\frac{1}{2}$	43.9823	25	78.540	47	147.655	79	248.186
4 $\frac{1}{2}$	1.6726	4 $\frac{1}{2}$	4.4179	5 $\frac{1}{2}$	7.5595	6 $\frac{1}{2}$	11.9773	8 $\frac{1}{2}$	18.2605	10 $\frac{1}{2}$	27.0062	14 $\frac{1}{2}$	44.7677	25 $\frac{1}{2}$	80.111	48	150.796	80	251.327
4 $\frac{3}{4}$	1.8744	4 $\frac{3}{4}$	4.5160	5 $\frac{3}{4}$	7.6576	6 $\frac{3}{4}$	12.1737	8 $\frac{3}{4}$	18.4569	10 $\frac{3}{4}$	27.4889	14 $\frac{3}{4}$	45.5531	26	81.681	49	153.938	81	254.469
5	1.9426	5	4.6142	6	7.7558	7	12.3700	9	18.6532	11	27.8816	14 $\frac{3}{4}$	46.3385	26 $\frac{1}{2}$	83.252	50	157.080	82	257.611
5 $\frac{1}{4}$	2.1578	5 $\frac{1}{4}$	4.7124	6 $\frac{1}{4}$	7.8540	7 $\frac{1}{4}$	12.5664	9 $\frac{1}{4}$	18.8496	11 $\frac{1}{4}$	28.2743	15	47.1240	27	84.823	51	160.221	83	260.752
5 $\frac{1}{2}$	2.3660	5 $\frac{1}{2}$	4.8106	6 $\frac{1}{2}$	7.9522	7 $\frac{1}{2}$	12.7627	9 $\frac{1}{2}$	19.0409	11 $\frac{1}{2}$	28.6670	15 $\frac{1}{2}$	47.9090	27 $\frac{1}{2}$	86.394	52	163.363	84	263.894
5 $\frac{3}{4}$	2.5771	5 $\frac{3}{4}$	4.9087	6 $\frac{3}{4}$	8.0503	7 $\frac{3}{4}$	12.9591	9 $\frac{3}{4}$	19.2423	11 $\frac{3}{4}$	29.0597	15 $\frac{3}{4}$	48.6950	28	87.965	53	166.504	85	267.035
6	2.7905	6	5.0069	7	8.1485	8	13.1554	10	19.4386	12	29.4524	15 $\frac{3}{4}$	49.4800	28 $\frac{1}{2}$	89.535	54	169.646	86	270.177
6 $\frac{1}{4}$	2.9935	6 $\frac{1}{4}$	5.1051	7 $\frac{1}{4}$	8.2467	8 $\frac{1}{4}$	13.3518	10 $\frac{1}{4}$	19.6350	12 $\frac{1}{4}$	29.8451	16	50.2650	29	91.106	55	172.788	87	273.319
6 $\frac{1}{2}$	3.2017	6 $\frac{1}{2}$	5.2033	7 $\frac{1}{2}$	8.3449	8 $\frac{1}{2}$	13.5481	10 $\frac{1}{2}$	19.8313	12 $\frac{1}{2}$	30.2378	16 $\frac{1}{2}$	51.0510	29 $\frac{1}{2}$	92.677	56	175.929	88	276.450
6 $\frac{3}{4}$	3.4158	6 $\frac{3}{4}$	5.3014	7 $\frac{3}{4}$	8.4430	8 $\frac{3}{4}$	13.7445	10 $\frac{3}{4}$	20.0277	12 $\frac{3}{4}$	30.6305	16 $\frac{3}{4}$	51.8360	30	94.248	57	179.071	89	279.602
7	3.6326	7	5.3996	8	8.5412	9	13.9408	11	20.2240	13	31.0232	16 $\frac{3}{4}$	52.6220	30 $\frac{1}{2}$	95.819	58	182.212	90	282.743
7 $\frac{1}{4}$	3.8522	7 $\frac{1}{4}$	5.4978	8 $\frac{1}{4}$	8.6394	9 $\frac{1}{4}$	14.1372	11 $\frac{1}{4}$	20.4204	13 $\frac{1}{4}$	31.4159	17	53.4070	31	97.380	59	185.354	91	285.885
7 $\frac{1}{2}$	4.0744	7 $\frac{1}{2}$	5.5960	8 $\frac{1}{2}$	8.7376	9 $\frac{1}{2}$	14.3335	11 $\frac{1}{2}$	20.6167	13 $\frac{1}{2}$	31.8086	17 $\frac{1}{2}$	54.1920	31 $\frac{1}{2}$	98.860	60	188.496	92	289.027
7 $\frac{3}{4}$	4.2985	7 $\frac{3}{4}$	5.6941	8 $\frac{3}{4}$	8.8357	9 $\frac{3}{4}$	14.5299	11 $\frac{3}{4}$	20.8131	13 $\frac{3}{4}$	32.2013	17 $\frac{3}{4}$	54.9780	32	100.531	61	191.637	93	292.168
8	4.5225	8	5.7923	9	8.9339	10	14.7262	12	21.0094	14	32.5940	17 $\frac{3}{4}$	55.7630	32 $\frac{1}{2}$	102.102	62	194.779	94	295.310
8 $\frac{1}{4}$	4.7489	8 $\frac{1}{4}$	5.8905	9 $\frac{1}{4}$	9.0321	10 $\frac{1}{4}$	14.9226	12 $\frac{1}{4}$	21.2058	14 $\frac{1}{4}$	32.9867	18	56.5490	33	103.673	63	197.920	95	298.451
8 $\frac{1}{2}$	4.9771	8 $\frac{1}{2}$	5.9887	9 $\frac{1}{2}$	9.1303	10 $\frac{1}{2}$	15.1189	12 $\frac{1}{2}$	21.4021	14 $\frac{1}{2}$	33.3794	18 $\frac{1}{2}$	57.3340	33 $\frac{1}{2}$	105.243	64	201.062	96	301.593
8 $\frac{3}{4}$	5.2082	8 $\frac{3}{4}$	6.0868	9 $\frac{3}{4}$	9.2284	10 $\frac{3}{4}$	15.3153	12 $\frac{3}{4}$	21.5984	14 $\frac{3}{4}$	33.7721	18 $\frac{3}{4}$	58.1190	34	106.814	65	204.204	97	304.734
9	5.4404	9	6.1850	10	9.3266	11	15.5116	13	21.7948	15	34.1648	18 $\frac{3}{4}$	58.9050	34 $\frac{1}{2}$	108.385	66	207.345	98	307.876

To determine the circumference of a circle, multiply the diameter by 3.1416.

Areas of Circles

Diameter	Area	Diameter	Area	Diameter	Area	Diameter	Area	Diameter	Area	Diameter	Area	Diameter	Area	Diameter	Area	Diameter	Area		
0		1	.7854	2	3.1416	3	7.0686	4	12.5664	5	19.6350	6	28.2743	7	38.4815	8	50.2655		
1	.00077	1 1/2	.8352	2 1/2	3.2405	3 1/2	7.3662	4 1/2	13.0690	5 1/2	20.1289	6 1/2	28.9690	7 1/2	39.8712	8 1/2	52.8225		
1 1/2	.00307	2	.8866	2 1/2	3.3410	3 1/2	7.6699	4 1/2	14.2825	5 1/2	20.6290	6 1/2	30.2655	7 1/2	42.7183	8 1/2	57.2617		
2	.00690	2 1/2	.9396	3	3.4430	4	7.9792	5	21.1352	6	21.6475	7	32.0690	8	44.1780	9	56.3050	10	72.8617
2 1/2	.01227	2 1/2	.9940	3 1/2	3.5466	4 1/2	8.2958	5 1/2	21.6475	6 1/2	32.0690	7 1/2	44.1780	8 1/2	57.2617	9 1/2	72.8617		
3	.01618	3	1.0500	4	3.6516	5	8.6179	6	22.1660	7	32.0690	8	44.1780	9	56.3050	10	72.8617	11	97.9617
3 1/2	.02761	3 1/2	1.1075	4 1/2	3.7583	5 1/2	8.9462	6 1/2	22.6906	7 1/2	32.0690	8 1/2	44.1780	9 1/2	56.3050	10 1/2	72.8617		
4	.03758	4	1.1666	5	3.8664	6	9.2806	7	23.2214	8	32.0690	9	44.1780	10	56.3050	11	72.8617	12	97.9617
4 1/2	.04909	4 1/2	1.2272	5 1/2	3.9761	6 1/2	9.6211	7 1/2	23.7583	8 1/2	32.0690	9 1/2	44.1780	10 1/2	56.3050	11 1/2	72.8617		
5	.06213	5	1.2893	6	4.0873	7	9.9678	8	24.3013	9	32.0690	10	44.1780	11	56.3050	12	72.8617	13	97.9617
5 1/2	.07670	5 1/2	1.3530	6 1/2	4.2000	7 1/2	10.3206	8 1/2	24.8505	9 1/2	32.0690	10 1/2	44.1780	11 1/2	56.3050	12 1/2	72.8617		
6	.09281	6	1.4182	7	4.3143	8	10.6796	9	25.4058	10	32.0690	11	44.1780	12	56.3050	13	72.8617	14	97.9617
6 1/2	.11045	6 1/2	1.4849	7 1/2	4.4301	8 1/2	11.0447	9 1/2	25.9672	10 1/2	32.0690	11 1/2	44.1780	12 1/2	56.3050	13 1/2	72.8617		
7	.12962	7	1.5532	8	4.5475	9	11.4159	10	26.5348	11	32.0690	12	44.1780	13	56.3050	14	72.8617	15	97.9617
7 1/2	.15033	7 1/2	1.6230	8 1/2	4.6604	9 1/2	11.7932	10 1/2	27.1085	11 1/2	32.0690	12 1/2	44.1780	13 1/2	56.3050	14 1/2	72.8617		
8	.17258	8	1.6943	9	4.7868	10	12.1767	11	27.6884	12	32.0690	13	44.1780	14	56.3050	15	72.8617	16	97.9617
8 1/2	.19635	8 1/2	1.7672	9 1/2	4.9087	10 1/2	12.5664	11 1/2	28.2743	12 1/2	32.0690	13 1/2	44.1780	14 1/2	56.3050	15 1/2	72.8617		
9	.22166	9	1.8415	10	5.0322	11	12.9621	12	28.6665	13	32.0690	14	44.1780	15	56.3050	16	72.8617	17	97.9617
9 1/2	.24850	9 1/2	1.9175	10 1/2	5.1572	11 1/2	13.3640	12 1/2	29.4647	13 1/2	32.0690	14 1/2	44.1780	15 1/2	56.3050	16 1/2	72.8617		
10	.27688	10	1.9940	11	5.2838	12	13.7721	13	30.0690	14	32.0690	15	44.1780	16	56.3050	17	72.8617	18	97.9617
10 1/2	.30680	10 1/2	2.0730	11 1/2	5.4119	12 1/2	14.1863	13 1/2	30.6796	14 1/2	32.0690	15 1/2	44.1780	16 1/2	56.3050	17 1/2	72.8617		
11	.33824	11	2.1545	12	5.5415	13	14.6066	14	31.2963	15	32.0690	16	44.1780	17	56.3050	18	72.8617	19	97.9617
11 1/2	.37122	11 1/2	2.2365	12 1/2	5.6727	13 1/2	15.0330	14 1/2	31.9191	15 1/2	32.0690	16 1/2	44.1780	17 1/2	56.3050	18 1/2	72.8617		
12	.40574	12	2.3202	13	5.8054	14	15.4656	15	32.5480	16	32.0690	17	44.1780	18	56.3050	19	72.8617	20	97.9617
12 1/2	.44179	12 1/2	2.4020	13 1/2	5.9396	14 1/2	15.9043	15 1/2	33.1831	16 1/2	32.0690	17 1/2	44.1780	18 1/2	56.3050	19 1/2	72.8617		
13	.47937	13	2.4892	14	6.0753	15	16.3492	16	33.8243	17	32.0690	18	44.1780	19	56.3050	20	72.8617	21	97.9617
13 1/2	.51840	13 1/2	2.5802	14 1/2	6.2126	15 1/2	16.8002	16 1/2	34.4716	17 1/2	32.0690	18 1/2	44.1780	19 1/2	56.3050	20 1/2	72.8617		
14	.55914	14	2.6660	15	6.3515	16	17.2573	17	34.9678	18	32.0690	19	44.1780	20	56.3050	21	72.8617	22	97.9617
14 1/2	.60132	14 1/2	2.7612	15 1/2	6.4918	16 1/2	17.7205	17 1/2	35.5247	18 1/2	32.0690	19 1/2	44.1780	20 1/2	56.3050	21 1/2	72.8617		
15	.64504	15	2.8540	16	6.6337	17	18.1899	18	36.0304	19	32.0690	20	44.1780	21	56.3050	22	72.8617	23	97.9617
15 1/2	.69029	15 1/2	2.9483	16 1/2	6.7771	17 1/2	18.6655	18 1/2	36.5304	19 1/2	32.0690	20 1/2	44.1780	21 1/2	56.3050	22 1/2	72.8617		
16	.73708	16	3.0442	17	6.9221	18	19.1472	19	37.8004	20	32.0690	21	44.1780	22	56.3050	23	72.8617	24	97.9617

To determine the Area of a Circle multiply the square of its diameter by .7854. Example, a 12-inch circle: $12 \times 12 = 144 \times .7854 = 113.0976$ inches, the area of a 12-inch circle.

Capacities of Cylindrical Tanks

In U. S. Standard Gallons

Depth or Length Ft.	DIAMETER IN FEET.														
	3	3½	4	4½	5	6	7	8	9	10	12	14	16	18	20
5	264	359	470	594	734	1057	1439	1880	2379	2937	4230	5757	7520	9518	11750
6	317	431	564	713	881	1269	1727	2256	2855	3525	5076	6909	9024	11421	14100
7	370	503	658	832	1028	1480	2015	2632	3331	4112	5922	8060	10528	13325	16450
8	423	575	752	951	1175	1692	2303	3008	3807	4700	6768	9212	12032	15228	18800
9	475	647	846	1070	1321	1903	2590	3384	4283	5287	7614	10363	13536	17132	21150
10	528	719	940	1189	1468	2115	2878	3760	4758	5875	8460	11515	15041	19036	23501
11	581	791	1034	1308	1615	2326	3166	4136	5234	6462	9306	12666	16545	20939	25851
12	634	863	1128	1427	1762	2538	3454	4512	5710	7050	10152	13818	18049	22843	28201
13	687	935	1222	1546	1909	2749	3742	4888	6186	7637	10998	14969	19553	24746	30551
14	740	1007	1316	1665	2056	2961	4030	5264	6662	8225	11844	16121	21057	26650	32901
15	793	1079	1410	1784	2203	3172	4318	5640	7138	8812	12690	17272	22561	28554	35251
16	846	1151	1504	1903	2350	3384	4606	6016	7614	9400	13536	18424	24065	30457	37601
17	899	1223	1598	2022	2496	3595	4893	6392	8090	9987	14382	19575	25569	32361	39951
18	951	1295	1692	2141	2643	3807	5181	6768	8566	10575	15228	20727	27073	34264	42301
19	1004	1367	1786	2260	2790	4018	5469	7144	9041	11162	16074	21878	28577	36168	44651
20	1057	1439	1880	2379	2937	4230	5757	7520	9517	11750	16920	23030	30082	38072	47002

If the tank is tapering, take the diameter four-tenths from the large end.
The U. S. Standard Gallon measures 231 cubic inches and contains 8.34 pounds of distilled water.

Relative Carrying Capacities or Equation of Pipes

(Figures above diagonal line are for Standard Steam, Gas and Water Pipes.)

Diameter	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	4	5	6	7	8	9	10	12	14	16	Diameter
$\frac{1}{2}$																		$\frac{1}{2}$
$\frac{3}{4}$	2.60																	$\frac{3}{4}$
1	7.55	2.90																1
$1\frac{1}{2}$	24.2	9.30	3.20															$1\frac{1}{2}$
2	54.8	21.0	7.25	2.26														2
$2\frac{1}{2}$	102	39.4	13.6	4.23	1.87													$2\frac{1}{2}$
3	170	65.4	22.6	7.03	3.11	1.66												3
4	376	144	49.8	15.5	6.87	3.67	2.21											4
5	686	263	90.9	28.3	12.5	6.70	4.03	1.83										5
6	1116	429	148	46.0	20.4	10.9	6.56	2.97	1.63									6
7	1707	656	226	70.5	31.2	16.6	10.0	4.54	2.49	1.51								7
8	2435	936	322	101	44.5	23.8	14.3	6.48	3.54	2.18	1.43							8
9	3335	1281	440	137	60.8	32.5	19.5	8.85	4.85	2.98	1.95	1.37						9
10	4393	1688	582	181	80.4	42.9	25.8	11.7	6.40	3.93	2.57	1.80	1.32					10
12	7087	2723	938	293	129	69.2	41.6	18.8	10.3	6.34	4.15	2.91	2.13	1.61				12
14	10600	4070	1403	438	193	103	62.2	28.2	15.4	9.48	6.21	4.35	3.18	2.41	1.50			14
16	14978	5758	1984	619	274	146	88.0	39.9	21.8	13.4	8.78	6.15	4.51	3.41	2.12	1.42		16
Diameter	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	4	5	6	7	8	9	10	12	14	16	Diameter

(Figures below diagonal line are for pipes of the actual internal diameters given.)

Explanation—The above table gives the number of pipes of one size required to equal in delivery other larger pipes of same length and under same conditions. As the nominal diameters of “standard” steam, gas and water pipes vary from the actual diameters, the table is made to cover both nominal and actual diameters. The upper portion, above the diagonal line, pertains to “standard” steam, gas and water pipe, while the lower portion is for pipes of the actual internal diameters given.

The figures given in the table, opposite the intersection of any two sizes, is the number of the smaller sized pipes required to equal one of the larger.

Percentage of Saving in Fuel Effected by Heating Feed Water

(Boiler Pressure 90 Pounds)

Temperature When Delivered to Boiler.	PRIMARY TEMPERATURE OF FEED WATER.							
	32°	40°	50°	60°	70°	80°	90°	100°
60 Degrees	2.3	1.7	.8					
70 "	3.2	2.5	1.7	.8				
80 "	4.0	3.4	2.5	1.7	.8			
90 "	4.9	4.2	3.4	2.5	1.7	.8		
100 "	5.7	5.0	4.2	3.4	2.5	1.7	.8	
110 "	6.6	5.9	5.0	4.2	3.4	2.5	1.7	.8
120 "	7.4	6.7	5.9	5.0	4.2	3.4	2.5	1.7
130 "	8.3	7.6	6.7	5.9	5.0	4.2	3.4	2.5
140 "	9.1	8.4	7.6	6.7	5.9	5.0	4.2	3.4
150 "	9.9	9.3	8.4	7.6	6.7	5.9	5.0	4.2
160 "	10.8	10.1	9.3	8.4	7.6	6.7	5.9	5.0
170 "	11.6	11.0	10.1	9.3	8.4	7.6	6.7	5.9
180 "	12.5	11.8	11.0	10.1	9.3	8.4	7.6	6.7
190 "	13.3	12.6	11.8	11.0	10.1	9.3	8.4	7.6
200 "	14.2	13.5	12.6	11.8	11.0	10.1	9.3	8.4
210 "	15.0	14.3	13.5	12.6	11.8	11.0	10.1	9.3
220 "	15.9	15.2	14.3	13.5	12.6	11.8	11.0	10.1

Note:—The above table gives the saving in fuel effected by heating the feed water before it enters the Boiler. This saving is all clear gain when advantage is taken of heat units which would otherwise be wasted. Exhaust steam from the engine is most frequently employed for this purpose although sometimes the waste heat in the chimney gases is utilized. Experiment has demonstrated that nothing is gained by the use of live steam to heat the feed water as the loss in energy under such arrangement fully offsets the gain in the generation of steam.

In addition to the saving given above the value of feed water purification must be considered for if the heating apparatus is designed to extract the impurities which the water contains, the fuel consumption will be materially decreased. It is estimated that an incrustation of $\frac{1}{8}$ inch will cause a loss of 13 per cent. of fuel; $\frac{1}{4}$ inch, 25 per cent, and so on, and these figures are probably not far from correct.

Suggestions for Inquiries and Orders.

The estimate number affords a convenient and accurate means of reference and identification and its use is encouraged. Orders and Inquiries should particularly specify any and all variations from the equipment mentioned as being included in each standard outfit; otherwise it will be assumed that the standard specifications are referred to.

Orders should always state:

Whether independent dome, riveted dome, dry pipe, or boiler without either dome or dry pipe, is wanted.

The type of grate bar that is preferred. The choice of several different styles as shown on page 25 is offered with all stationary tubular boilers. Owing to limitations in furnace dimensions, Herringbone and Sawdust grate bars are not adaptable to all sizes of portable fire box boilers.

If other than the standard fire front, as listed in this catalogue beneath the several tables of specifications, is wanted, mention of it must be made in the order. When plain full square or ornamental fronts are ordered with boilers 48 inches by 12 feet or smaller, wings or loops must be provided at the front end of boiler for its support.

What character of setting will be employed when more than one boiler is to be installed. Separate setting is understood to mean that each boiler will set entirely alone, separate from and without connection to the setting of any other boiler. Independent setting is understood to mean that the several boilers involved will set side by side in one run of brick-work, but with division walls between them. Battery setting is understood to mean that the several boilers involved will set side by side with furnaces thrown together.

If more than one boiler is called for, the order should clearly show whether a smoke stack is wanted for each boiler or only one for the several boilers. If the latter, the order should state whether a smoke connection is wanted and if so which style; also whether a stack plate is wanted.

